

# Fish Lake Aquatic Vegetation Management Plan Update 2006

LaPorte County, Indiana

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# **FISH LAKE AQUATIC PLANT MANAGEMENT PLAN LAPORTE COUNTY, INDIANA**

## **EXECUTIVE SUMMARY**

This document is intended to update the 2005 Aquatic Plant Management Plan for Upper and Lower Fish Lakes, LaPorte County, Indiana. The following update specifically addresses the results of the aquatic plant chemical treatments conducted during the 2006 season. The Aquatic Plant Management Plan of 2005 should be consulted for complete information regarding aquatic plant management at Fish Lakes.

In 2006, the only method of control was chemical in nature. Treatment was intended to target Eurasian watermilfoil and curly-leaf pondweed, both invasive, exotic species in Indiana, as well as algae. On June 8, 2005, Weed Patrol, Inc. (Elkhart, Indiana) treated approximately 60 acres of curly-leaf pondweed and 80 acres of Eurasian watermilfoil. Two separate treatments occurred targeting the two species. Due to differences in acreage treated and dosage utilized, treatment methodologies varied based on the targeted plant species. A moderate rate of Aquathol K herbicide (1 gallon per acre) was used to control curly-leaf pondweed while not harming native pondweeds or other aquatic species. Likewise, since a relatively large area was treated selectively, Eurasian watermilfoil control herbicide was applied at a moderate rate (roughly 2-3 gallons per acre of Renovate 3 herbicide). Also on June 8, 2006, the channel connecting Upper and Lower Fish Lakes was treated for algae (using copper sulfate and Cygnet Plus herbicide), as well as nuisance aquatic plants (using Reward herbicide for broad spectrum aquatic plant control). On July 12, 2006, Weed Patrol, Inc. conducted a whole-lake treatment for algae, again using copper sulfate and Cygnet Plus. Finally, on August 9, 2006, one bed on Upper Fish and two beds on Lower Fish Lakes (totaling 9 acres) were treated for Eurasian watermilfoil using 2,4-D Herbicide. 2,4-D was utilized for spot treatment purposes due to the comfort level of the applicator with the selectivity and effectiveness of this chemical during late summer conditions in these lakes. Furthermore, a granular form was utilized due to the small, isolated treatment areas (Tony Cunningham, Weed Patrol, personal communication).

Tier I surveys were conducted before and after chemical treatment occurred to determine the nature of the plant community and effectiveness of treatment. A Tier II survey was also conducted after treatment to gather additional information on the plant communities of Fish Lakes. In comparing 2006 pre- and post-treatment Tier I data, it is clear that herbicide treatment was effective in providing seasonal control of Eurasian watermilfoil. No Eurasian watermilfoil was detected in the summer (post-treatment) Tier I or Tier II surveys. However, because 2006 data cannot accurately be compared to 2004 and 2005 survey data, no conclusions can be made about the long-term impacts of treatment on Eurasian watermilfoil bed size or density.

Abundance of curly-leaf pondweed also decreased after treatment. However, the true impact of treatment on curly-leaf pondweed populations remains elusive as curly-leaf pondweed density naturally declines in the summer due to increased water temperatures. The true extent of curly-leaf pondweed infestation is also unknown; for increased accuracy and to maximize results, both assessment and treatment of curly-leaf pondweed should occur early in the growing season when water temperatures are 30 to 40° F.

The effects of treatment on the native plant community are unclear. There is no noticeable change in the number of species detected in pre- and post-treatment Tier I surveys. Both Upper and Lower Fish Lakes possessed Tier II metric values greater than the average values for plant community metrics found by Pearson (2004) for 21 northern Indiana lakes, including those for native plant numbers and native species richness. However, because Pearson's study was not intended nor designed to create baseline native aquatic plant data for evaluative purposes, over-reliance on comparisons to Pearson's data in making management decisions should be avoided.

Additional items including a Tier I Survey; a public meeting; and a meeting between the contractors, LARE program staff, and the district fisheries biologist also occurred in concert with this aquatic plant management plan update. The details of these are not repeated here, but were utilized to generate recommendations as follows:

1. Early season assessment and treatment of curly-leaf pondweed. Assessment and treatment should occur when water temperatures are at 30 to 40° F. It is estimated that treatment will target 60 acres of curly-leaf pondweed. As the LARE program cannot guarantee funding for curly-leaf pondweed treatment for 2007 at this time, the FLCD should include this expenditure in their budget for 2007. The bidding process for this treatment should be conducted as an open-bidding process with all steps documented for the LARE program. The selected herbicide applicator must be approved by the LARE program prior to contract signing and subsequent treatment. A copy of the signed contract must be on file with the LARE program staff prior to treatment occurring. If funding for curly-leaf pondweed treatment is deemed feasible by the LARE program staff, the FLCD will be reimbursed for the approved funding amount, if and only if, all steps of the bidding process and the signed contract are on file with the LARE staff prior to treatment occurring.
2. Assessment of streams draining into Fish Lake is also necessary. These areas are thought to act as nurseries for Eurasian watermilfoil. Treatment of these areas should result in less reintroduction of Eurasian watermilfoil from the channels into the main body of the lakes. Until these areas are addressed, Eurasian watermilfoil will continue to reinfest Fish Lake.
3. Treatment of approximately 80 acres of Eurasian watermilfoil and 60 acres of curly-leaf pondweed throughout the Fish Lakes. Areas are identified in the following sections, but should be confirmed prior to treatment occurring in 2007.
4. Continue pre- and post-treatment assessments to determine how the aquatic plant community within the Fish Lakes changes over time. The LARE program will require a map detailing exotic plant locations prior to treatment and a post-treatment Tier II (point) survey, which should occur between July 15 and August 30, 2007.

## **ACKNOWLEDGEMENTS**

The Indiana Department of Natural Resources Division of Fish & Wildlife as part of the Lake and River Enhancement Program (LARE) provided funding for the development of this plan. The plan has been developed in cooperation with the Fish Lake Conservancy District. Fieldwork, data analysis and map generation was performed by JFNew with the assistance of Scott Namestnik, Tony Troche, Mark Prankus, and Sara Peel. Special thanks to Tony Cunningham and Weed Patrol staff for their historical information, treatment details, and recommendations for 2007 treatment. Contributors include: Sara Peel, Mandy Beall, Mark Prankus, and Scott Namestnik.

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- Appendix B: Summer Tier I Survey datasheets and Tier II raw data
- Appendix C: Hydrilla information
- Appendix D: DNR Permit Applications





# **FISH LAKE AQUATIC PLANT MANAGEMENT PLAN UPDATE LAPORTE COUNTY, INDIANA**

## **1.0 Introduction**

This report serves as an update to the 2005 Fish Lake Aquatic Plant Management Plan. The update will serve as a tool to track changes in the vegetation community, to adjust the action plan as needed, and to maintain eligibility for additional LARE funds. Items covered include a review of details of the 2006 vegetation control efforts; spring and summer Tier I and summer Tier II results from the 2006 season; and a discussion of potential management implications of the results. The plan update was funded by the Indiana Department of Natural Resources (IDNR) Lake and River Enhancement Program (LARE) and the Fish Lake Conservancy District (FLCD). This is the second year that that Fish Lake has been involved in aquatic plant management planning through the LARE program.

During the 2006 growing season the following actions were taken.

- June 6, 2006: Tier I aquatic plant survey completed on both lakes.
- June 8, 2006: 80 acres of Eurasian watermilfoil and 60 acres of curly-leaf pondweed treated on both lakes; connecting channel treated for algae and nuisance aquatic plants.
- July 12, 2006: Lakewide algae treatments conducted on both lakes.
- August 8, 2006: 9 acres of Eurasian watermilfoil treated on both lakes.
- August 10-14, 2006: Tier I and Tier II aquatic plant surveys completed on both lakes.
- October 21, 2006: Public meeting with the FLCD board and local property owners
- November 30, 2006: Meeting with LARE staff, herbicide applicator, and JFNew to discuss 2006 results and recommended treatment for 2007

## **2.0 Watershed and Lake Characteristics**

See Fish Lake Aquatic Plant Management Plan DRAFT (Weed Patrol, 2005).

## **3.0 Lake Uses**

See Fish Lake Aquatic Plant Management Plan DRAFT (Weed Patrol, 2005).

## **4.0 Fisheries**

See Fish Lake Aquatic Plant Management Plan DRAFT for the most recent fisheries information (Weed Patrol, 2005). No fisheries updates occurred within the past year.

## **5.0 Problem Statement**

Previous aquatic plant assessments identified the presence of Eurasian watermilfoil and curly-leaf pondweed as the two primary exotic nuisance species located within the Fish Lakes. These two species continue to be problematic throughout the areas previously identified. Fish Lake Conservancy District has treated for both species since 2000 (Weed Patrol, 2005). Treatments have been somewhat successful in seasonal control and containment, but it is unclear if they have significantly reduced established beds over the long term. Additionally, there is potential for continued Eurasian watermilfoil fragment introduction from upstream infestations via Mill Creek.

## **6.0 Vegetation Management Goals and Objectives**

The Fish Lake Conservancy District identified three management goals during the development of their initial aquatic plant management plan (Weed Patrol, 2005). These goals correspond to the three

goals developed by the IDNR for aquatic plant communities within Indiana lakes. As none of the goals or objectives changed based on this year's assessments; the goals are not restated here. Please refer to the Fish Lake Aquatic Plant Management Plan DRAFT for more information on their goals (Weed Patrol, 2005).

## **7.0 Plant Management History**

On June 8, 2006, Weed Patrol, Inc. (Elkhart, Indiana) treated approximately 60 acres of curly-leaf pondweed and 80 acres of Eurasian watermilfoil. Treatment occurred during excellent conditions; however, treatment occurred later than optimal for adequate, long-term curly-leaf pondweed control (Tony Cunningham, personal communication). Figures 1 and 2 illustrate the specific locations, plant species targeted (curly-leaf pondweed and Eurasian watermilfoil, respectively) and the size of the areas targeted during the aforementioned herbicide treatments. Most of the curly-leaf pondweed treatment occurred in the northeast and southwest portions of Upper Fish Lake, with two smaller areas also treated in northernmost Lower Fish. A moderate rate of Aquathol K herbicide (1 gallon per acre) and Reward (1-2 or 3-4 gallons/acre depending on water depth and curly-leaf pondweed maturity; Tony Cunningham, personal communication) was used to control curly-leaf pondweed while not harming native pondweeds or other aquatic species. Likewise, since a relatively large area was treated selectively, Eurasian watermilfoil control herbicide was applied at a moderate rate (roughly 2-3 gallons per acre or more precisely 1.8 gallons/acre-foot of Renovate 3 herbicide; Tony Cunningham, personal communication). Also on June 8, 2006, the channel connecting Upper and Lower Fish Lakes was treated for algae (using copper sulfate and Cygnet Plus herbicide), as well as nuisance aquatic plants (using Reward herbicide for broad spectrum aquatic plant control). On June 8, 2006, Weed Patrol, Inc. also treated the channel connecting Upper and Lower Fish Lakes, both for algae (using copper sulfate and Cygnet Plus herbicide), and nuisance aquatic plants (using Reward herbicide for broad spectrum aquatic plant control). Figure 3 illustrates the treatment area.

Subsequent surveys and treatment occurred multiple times throughout the remainder of the summer. Curly-leaf pondweed treatment was relatively successful resulting in die-off in 7-10 days. According to the aquatic herbicide applicator, this is a little slower than normal timeframes within this lake. Additionally, it should be noted that curly-leaf pondweed treatment occurred later than optimal, which may have resulted in less beneficial long-term treatment than during normal application times. Eurasian watermilfoil fell out of the water column after 10-14 days, which is typical for systemic herbicide treatment. The lakes were inspected three times following treatment. These inspections occurred on June 18, 2006. Renovate assay samples were collected concurrent with this inspection. The second inspection occurred on July 12, 2006. Weed Patrol applied copper sulfate and Cygnet Plus for algae control in both Upper and Lower Fish Lakes in concert with this inspection. (See Figure 4 for treatment areas.)

The final inspection occurred on August 9, 2006. During this treatment, any Eurasian watermilfoil identified was treated. This included treatment of one bed on Upper Fish and two beds on Lower Fish Lakes (totaling 9 acres) using 2, 4-D herbicide. Figure 1 illustrates the specific locations of these targeted plant beds. 2, 4-D was utilized for spot treatment purposes due to the comfort level of the applicator with the selectivity and effectiveness of this chemical during late summer conditions in these lakes. Furthermore, a granular form was utilized due to the small, isolated treatment areas (Tony Cunningham, Weed Patrol, personal communication). The aforementioned chemical treatments were funded by the DNR LARE program with local match provided by the Fish Lake Conservancy District.



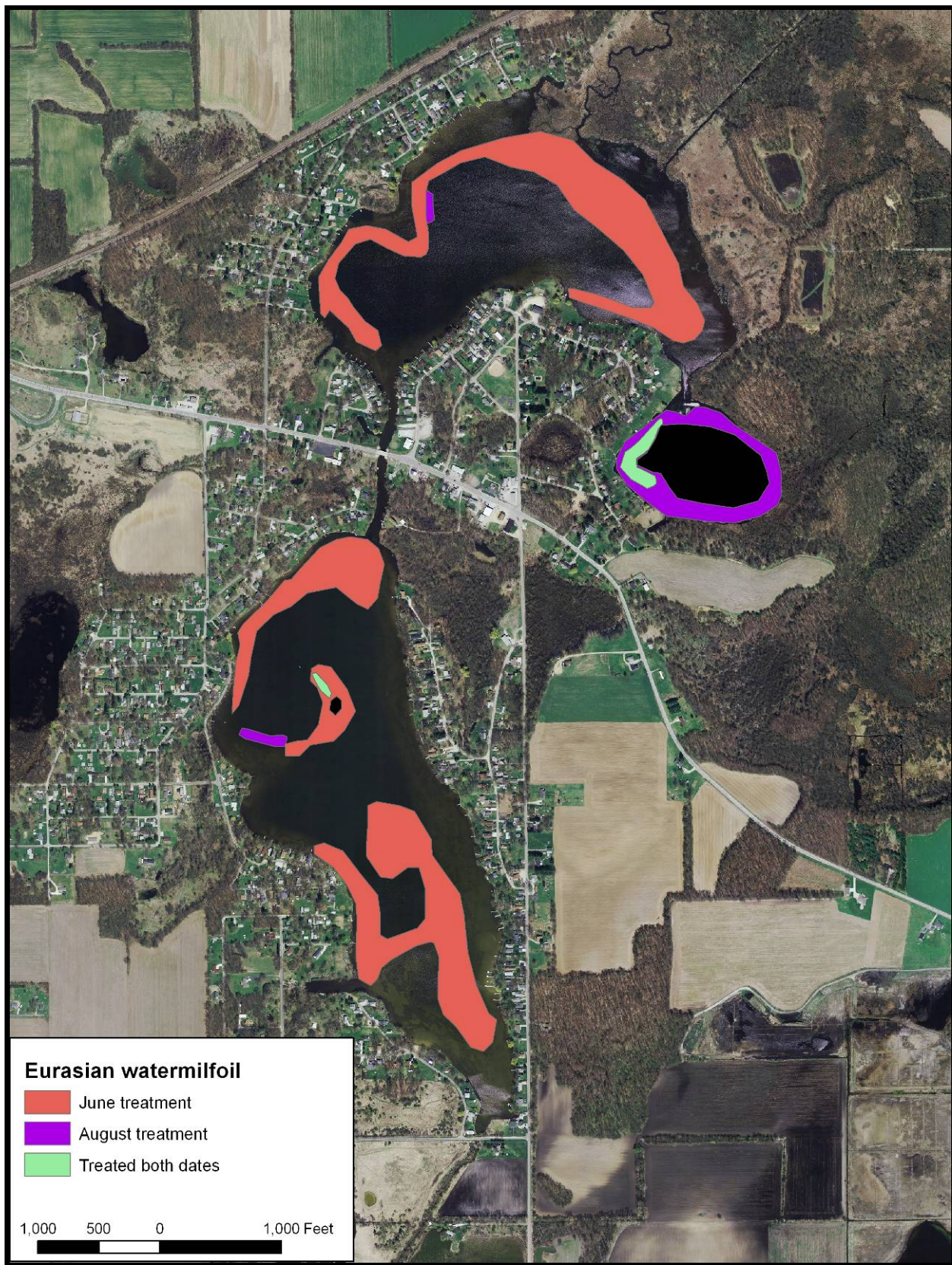


Figure 1. Eurasian watermilfoil treatment locations, June and August 2006.





Figure 2. Curly-leaf pondweed treatment locations, June and August 2006.





Figure 3. Channel treatment, June 2006.



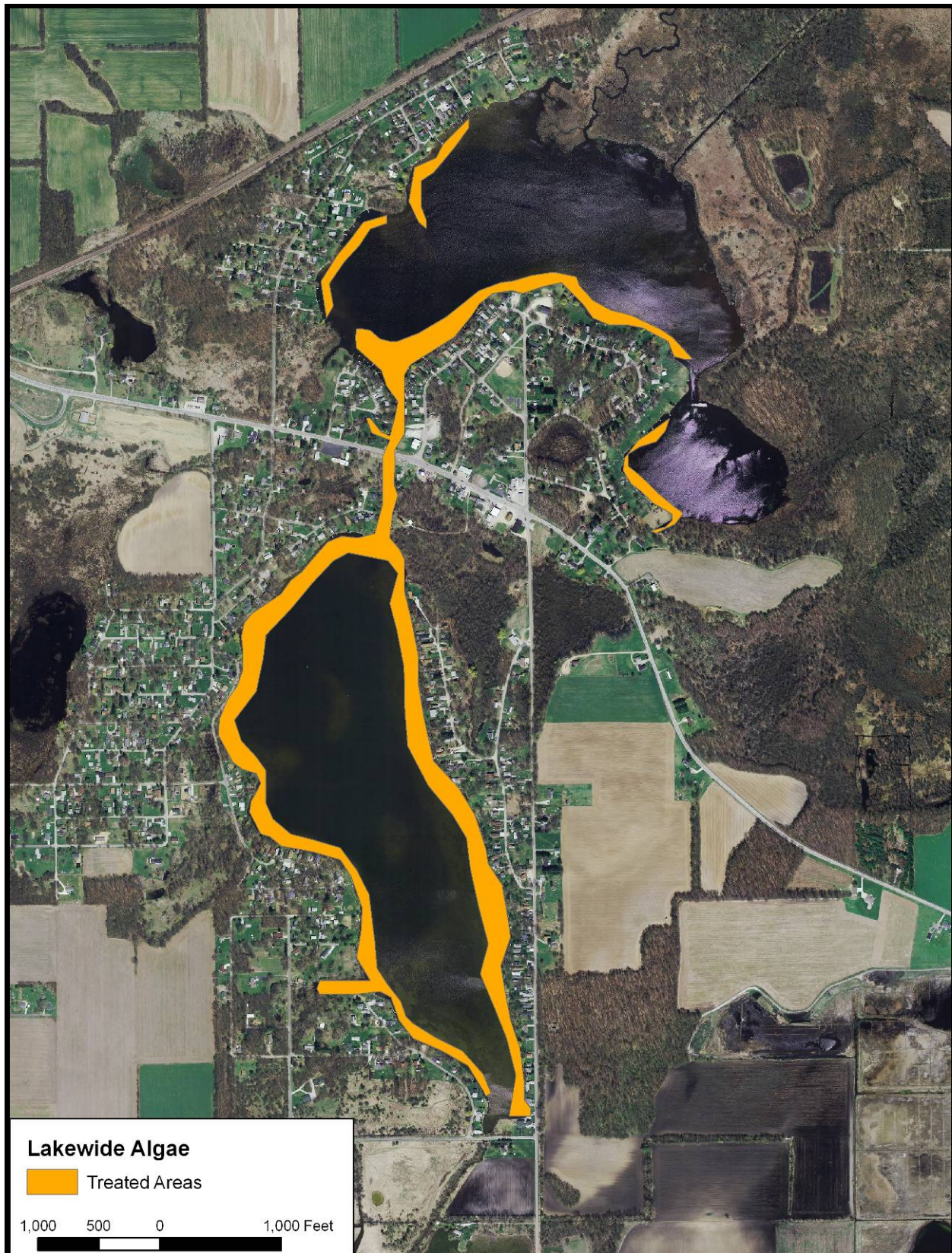


Figure 4. Whole-lake algae treatment, August 2006.



## **8.0 Aquatic Plant Community Characterization**

### **8.1 Methods**

JFNew surveyed Upper and Lower Fish Lakes on June 6 and August 10, 11, and 14, 2006 according to the Indiana Department of Natural Resources sampling protocols (IDNR, 2006a; IDNR, 2006b). JFNew examined the entire littoral zone of the lake during each of the three assessments. The two Tier I surveys completed on the Fish Lakes occurred on June 6 (both lakes) and August 11 (Upper Fish) and August 14 (Lower Fish), 2006. As defined in the Tier I protocol, the lake's littoral zone was estimated to be approximately three times the lake's Secchi disk depth. This estimate approximates the 1% light level, or the level at which light penetration into the water column is sufficient to support plant growth. JFNew surveyed Upper Fish Lake to a depth of 24 feet, while Lower Fish Lake was surveyed to a depth of 16 feet. As the Tier I protocol has not changed since the last aquatic plant management plan update, the specifics of the protocol are not repeated here.

The only Tier II survey completed on the Fish Lakes occurred on August 11, 2006. JFNew completed the survey using the Tier II survey protocol updated by the IDNR LARE staff in May 2006 (IDNR, 2006b). The survey protocol generally follows previous Tier II protocols; however, the 2006 protocol requires that the sampling points be stratified over the entire depth of the lake's littoral zone. Total points sampled per stratum were determined as follows:

1. Appendix D of the survey protocol was consulted to determine the number of points to be sampled. This determination was based on the lake size (surface area) and trophic status.
2. Table 3 of the survey protocol was referenced as an indicator of the number of sample points per stratum. Table 1 lists the sampling strategy for Upper and Lower Fish Lakes.

The Tier II survey protocol was modified slightly due to Lower Fish Lake not containing water in the 20-25 foot stratum (maximum depth=16 feet). Based on this and to ensure that a total of 50 points were sampled, points were distributed as if the lake were mesotrophic in nature.

**Table 1. Tier II sampling strategy for Upper and Lower Fish Lakes using the 2006 Tier II protocol.**

<b>Lake</b>	<b>Size</b>	<b>Trophic Status</b>	<b>Number of Points</b>	<b>Stratification of Points</b>
Upper Fish	139 acres	Mesotrophic	50	14 pts 0-5 foot stratum 14 pts 5-10 foot stratum 12 pts 10-15 foot stratum 10 pts 15-20 foot stratum
Lower Fish	177 acres	Oligotrophic	50	14 pts 0-5 foot stratum 14 pts 5-10 foot stratum 12 pts 10-15 foot stratum 10 pts 15-20 foot stratum

### **8.2 2006 Sampling Results**

Pre- and post-treatment Tier I surveys and a post-treatment Tier II survey were completed on both Upper and Lower Fish Lakes in 2006 by JFNew. The survey schedule for both lakes is detailed in Table 2. No species were sent to an outside taxonomist for vouchering or identification.

**Table 2. Survey schedule of Tier I and II surveys.**

Survey	Date
Pre-treatment Tier I - Spring	June 6 <sup>th</sup> , 2006
Post-treatment Tier II -Summer	August 11 <sup>th</sup> and 14 <sup>th</sup> , 2006
Post-treatment Tier II -Summer	August 11 <sup>th</sup> , 2006

### **8.2.1 Tier I**

Plant beds identified in Upper and Lower Fish Lakes are detailed in Figure 5. Additional plant bed information is discussed in detail in the following sections. Two Tier I surveys were completed in order to document changes in the plant community resulting from the aquatic herbicide treatments. The Tier I surveys were completed on June 6, 2006 (“pre-treatment”) and on August 10 and 14, 2006 (“post-treatment”).

#### **Upper Fish Lake**

The Tier I surveys on Upper Fish Lake revealed two distinct plant beds covering approximately 107 acres (Figure 5). Vegetation sampled in the channel connecting the two lakes is also included with the Upper Fish Lake data. A total of 42 different species were observed in both pre- and post-treatment surveys. Though the species lists from the two surveys differ, emergent and submerged plants dominated the plant beds within Upper Fish Lake before and after treatment. Of the 42 species found pre- and post-treatment, 14 emergent species and 20 submerged species were found. Seven floating species and filamentous algae accounted for the remaining 8 species. Lists of all of the plants identified during the Tier I pre-treatment and post-treatment surveys on Upper Fish Lake are summarized in Tables 3 and 4, respectively. Plant abundance ratings are also included in these tables. Appendix A contains copies of the Tier I data sheets from June, while Appendix B contains data sheets from August.



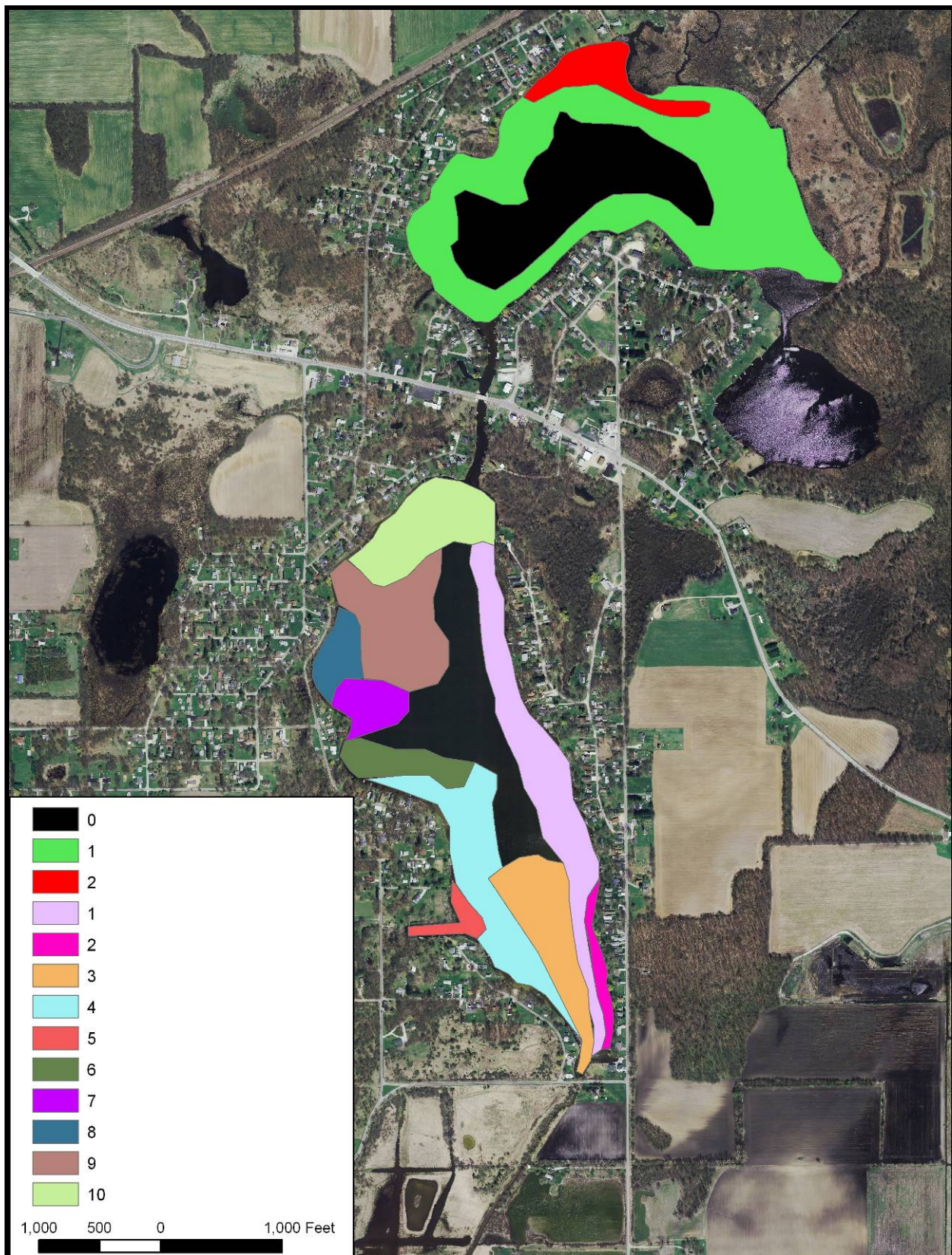


Figure 5. Plant Beds found in Upper and Lower Fish Lakes, June 6, August 10 and 14, 2006.

**Table 3. Upper Fish Lake Pre-treatment Tier I survey results, June 6, 2006.**

Scientific Name	Common Name	Stratum	Bed 1	Bed 2	Connecting Channel
<i>Acer saccharium</i>	Silver maple	Emergent	<2%	--	--
<i>Ceratophyllum demersum</i>	Coontail	Submergent	21-60%	<2%	2-20%
<i>Chara species</i>	Chara species	Submergent	>60%	2-20%	21-60%
<i>Carex Comosa</i>	Bearded sedge	Submergent	--	--	<2%
<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent	<2%	2-20%	<2%
<i>Elodea canadensis</i>	Common water weed	Submergent	<2%	21-60%	2-20%
<i>Filamentous algae</i>	Filamentous algae	Algae	21-60%	2-20%	2-20%
<i>Iris virginica</i>	Blue-flag iris	Emergent	<2%	--	--
<i>Leersia oryzoides</i>	Rice cut grass	Emergent	--	--	<2%
<i>Lemna minor</i>	Common duckweed	Floating	<2%	<2%	<2%
<i>Lemna trisulca</i>	Star duckweed	Floating	<2%	<2%	<2%
<i>Ludwigia polycarpa</i>	False loosestrife	Emergent	--	--	<2%
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	<2%	--	<2%
<i>Myosotis scorpioides</i>	True forget-me-not	Emergent	<2%	--	--
<i>Myriophyllum heterophyllum</i>	Various-leaved watermilfoil	Submergent	<2%	--	--
<i>Myriophyllum exalbescent</i>	Northern watermilfoil	Submergent	<2%	--	--
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent	<2%	2-20%	2-20%
<i>Najas guadalupensis</i>	Southern naiad	Submergent	<2%	--	<2%
<i>Nuphar advena</i>	Spatterdock	Floating	<2%	21-60%	2-20%
<i>Nuphar variegatum</i>	Bullhead lily	Floating	2-20%	2-20%	2-20%
<i>Nyphaea tuberosa</i>	White water lily	Floating	<2%	21-60%	2-20%
<i>Peltandra virginica</i>	Arrow arum	Emergent	<2%	--	2-20%
<i>Phalaris arundinacea</i>	Reed canary grass	Emergent	2-20%	<2%	--
<i>Phragmites australis</i>	Common reed	Emergent	--	<2%	<2%
<i>Potamogeton berchtoldii</i>	Broad-leaf small pondweed	Submergent	--	--	<2%
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	21-60%	<2%	<2%
<i>Potamogeton foliosus</i>	Leafy pondweed	Submergent	<2%	<2%	<2%
<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent	<2%	--	--
<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent	<2%	--	<2%
<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent	21-60%	2-20%	2-20%
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent	<2%	2-20%	<2%
<i>Ranunculus longirostris</i>	White water crowfoot	Submergent	<2%	<2%	--
<i>Sagittaria latifolia</i>	Common arrowhead	Submergent	--	--	<2%
<i>Scirpus americanus</i>	Olney's bulrush	Emergent	<2%	--	--
<i>Sparganium eurycarpum</i>	Common burreed	Emergent	<2%	--	--
<i>Spirodela polyrrhiza</i>	Large duckweed	Floating	<2%	<2%	<2%



Scientific Name	Common Name	Stratum	Bed 1	Bed 2	Connecting Channel
<i>Typha angustifolia</i>	Narrow leaved cattail	Emergent	<2%	--	--
<i>Typha latifolia</i>	Broad leaved cattail	Emergent	<2%	--	<2%
<i>Utricularia gibba</i>	Humped bladderwort	Submergent	<2%	<2%	--
<i>Utricularia vulgaris</i>	Common bladderwort	Submergent	2-20%	<2%	--
<i>Valisneria americana</i>	Eel grass	Submergent	21-60%	--	2-20%
<i>Wolffia species</i>	Water meal species	Floating	<2%	<2%	--

**Table 4. Upper Fish Lake Post-treatment Tier I survey results, August 11, 2006.**

Scientific Name	Common Name	Stratum	Bed 1	Connecting Channel
<i>Acer saccharum</i>	Silver maple	Emergent	<2%	--
<i>Asclepias incarnata</i>	Swamp milkweed	Submergent	<2%	--
<i>Ceratophyllum demersum</i>	Coontail	Submergent	21-60%	<2%
<i>Chara species</i>	Chara species	Submergent	>60%	2-20%
<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent	2-20%	<2%
<i>Elodea canadensis</i>	Common water weed	Submergent	2-20%	<2%
<i>Filamentous algae</i>	Filamentous algae	Algae	2-20%	<2%
<i>Heteranthera dubia</i>	Water star grass	Emergent	<2%	<2%
<i>Iris virginica</i>	Blue-flag iris	Emergent	<2%	--
<i>Leersia Oryzoides</i>	Rice cut grass	Emergent	--	<2%
<i>Lemna minor</i>	Common duckweed	Floating	<2%	<2%
<i>Lemna trisulca</i>	Star duckweed	Floating	<2%	<2%
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	<2%	<2%
<i>Myriophyllum exalbescent</i>	Northern watermilfoil	Submergent	<2%	--
<i>Myriophyllum heterophyllum</i>	Various leaved watermilfoil	Submergent	<2%	--
<i>Najas flexilis</i>	Slender naiad	Submergent	<2%	<2%
<i>Najas guadalupensis</i>	Southern naiad	Submergent	<2%	2-20%
<i>Nuphar advena</i>	Spatterdock	Floating	<2%	<2%
<i>Nuphar variegatum</i>	Bullhead lily	Floating	2-20%	2-20%
<i>Nymphaea tuberosa</i>	White water lily	Floating	2-20%	<2%
<i>Peltandra virginica</i>	Arrow arum	Emergent	<2%	2-20%
<i>Phalaris arundinacea</i>	Reed canary grass	Emergent	<2%	<2%
<i>Potamogeton berchtoldii</i>	Broad-leaf small pondweed	Submergent	--	<2%
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	<2%	<2%
<i>Potamogeton foliosis</i>	Leafy pondweed	Submergent	<2%	--
<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent	2-20%	<2%
<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent	2-20%	--
<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent	2-20%	2-20%
<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent	<2%	--

Scientific Name	Common Name	Stratum	Bed 1	Connecting Channel
<i>Ranunculus longirostris</i>	White water crowfoot	Submergent	<2%	--
<i>Sagittaria latifolia</i>	Common arrowhead	Submergent	<2%	<2%
<i>Scirpus acutus</i>	Hard-stem bulrush	Emergent	--	<2%
<i>Scirpus pungens</i>	Threesquare bulrush	Emergent	<2%	--
<i>Scirpus validus</i>	Soft-stem bulrush	Emergent	<2%	--
<i>Sparganeum eurycarpum</i>	Common burreed	Emergent	<2%	<2%
<i>Spirodela polyrrhiza</i>	Large duckweed	Floating	<2%	<2%
<i>Typha angustifolia</i>	Narrow leafed cattail	Emergent	<2%	<2%
<i>Typha latifolia</i>	Broad leafed cattail	Emergent	<2%	<2%
<i>Utricularia gibba</i>	Humped bladderwort	Submergent	2-20%	<2%
<i>Utricularia vulgaris</i>	Great bladderwort	Submergent	2-20%	<2%
<i>Valisneria americana</i>	Eel grass	Submergent	2-20%	21-60%
<i>Wolffia columbiana</i>	Columbia water-meal	Floating	<2%	--

### Bed 01

Bed 01 encompasses 100 of Upper Fish Lake's 139 acres making it the largest individual plant bed on either lake. It includes the entire shoreline, except for a small area at the northernmost part of the lake that is included in Bed 02 (Figure 5). This was the more diverse of the two beds in Upper Fish, containing species representing all three strata (submerged, emergent, and floating plants) during both pre- and post-treatment surveys.

Prior to treatment, Bed 01 contained 36 species. Plants were present and still relatively dense to a lake depth of approximately 10 feet. The most dominant plant was chara (>60%), while coontail, filamentous algae, curly-leaf pondweed, sago pondweed, and eel grass were also dominant covering 21-60% of the bed's canopy. Bullhead lily, reed canary grass, and common bladderwort were present in moderate density (2-20%). The remaining species that were detected, including Eurasian watermilfoil, were not abundant (<2% coverage). Submerged species dominated Bed 01 accounting for 17 of the 36 species, and all of the most dominant species (>21%) excluding algae. Eleven emergent species, 7 floating species, and the filamentous algae were also present at the time of the survey. Submerged vegetation covered more than 60% of the plant bed canopy; emergent and rooted floating vegetation covered 2-20%, respectively. Non-rooted floating vegetation covered less than 2% of the plant bed canopy.

Following treatment, Bed 01 contained 39 species. Again, chara predominated at greater than 60% abundance. Of the species that exhibited 21-60% dominance before treatment, only coontail remained. Instead, a larger group of species, including whirled loosestrife, common water weed, filamentous algae, bullhead lily, white water lily, grassy pondweed, Illinois pondweed, sago pondweed, humped bladderwort, great bladderwort, and eel grass were all present in moderate abundance (2-20%). Curly-leaf pondweed was once again detected, but was not abundant (<2%). Eurasian watermilfoil was not detected after treatment. Submerged species once again dominated Bed 01, accounting for 19 of the 39 species, including the two most abundant. Twelve emergent species, 7 floating species, and filamentous were present. The percentages of canopy covered by the three strata (submerged, emergent, and floating) were identical to pre-treatment.

### Bed 02

Bed 02 is located at the north end of Upper Fish Lake (Figure 5) and covers approximately 7 acres. This bed was inaccessible during the post-treatment survey, so only pre-treatment data was collected. JFNew detected 22 species representing all three strata (submerged, emergent, and floating plants) and algae during the spring, pre-treatment survey. The dominant species were common water weed, spatterdock, and white water lily, each of which covered 21-60% of the bed's canopy. Chara, whirled loosestrife, filamentous algae, Eurasian watermilfoil, bullhead lily, sago pondweed, and flat-stem pondweed were all moderately abundant (2-20%). The remaining species that were detected, including curly-leaf pondweed, were not abundant (<2% coverage). While submerged species accounted for half (11) of the total species in the bed, two of the most abundant species, spatterdock and white water lily, were floating plants. Five additional floating species and three emergent species were also found. Rooted floating vegetation covered more than 60% of the plant bed canopy, submerged vegetation covered 21-60%, emergent vegetation covered 2-20%, and non-rooted floating vegetation covered less than 2% of the plant bed canopy.

### Connecting Channel

The channel connecting Upper and Lower Fish Lakes runs north to south and passes under State Road 4. It is not included as a numbered plant bed, but is visible in Figure 5. The channel contained species representing all three strata (submerged, emergent, and floating plants) during both pre- and post-treatment surveys.

Prior to treatment, the channel contained 28 species. Chara was the dominant plant species (21-60%). Coontail, common water weed, filamentous algae, Eurasian watermilfoil, spatterdock, bullhead lily, white water lily, arrow arum, and sago pondweed were all moderately abundant, accounting for 2-20% of the canopy cover. The remaining 18 species, including curly-leaf pondweed, were not abundant (<2% coverage). Submerged species dominated the channel, accounting for 14 of the 28 species. Seven emergent species, 6 floating species, and filamentous algae were also present.

Following treatment, the channel contained 30 species. Eel grass was the dominant plant species (21-60%), while chara, southern naiad, bullhead lily, arrow arum, and sago pondweed were each present accounting for 2-20% of the canopy cover. Eurasian watermilfoil was not detected; curly-leaf pondweed was once again found in low abundance (<2%). Submerged and emergent plants accounted for 13 and 10 of the 30 species, respectively. Six floating species and filamentous algae were also present. Submerged vegetation covered 21-60% of the plant canopy, rooted floating vegetation covered 2-20%, and non-rooted floating vegetation and emergent plants both covered less than 2% of the plant bed canopy.

The most dominant species throughout Upper Fish Lake and the connecting channel were chara, coontail, and filamentous algae. Other species, including Eurasian watermilfoil, curly-leaf pondweed, and sago pondweed were also at least moderately abundant in one of the beds sampled. See the Beneficial and Problem Plants Section for further discussion of Upper Fish Lake plant beds.

## **Lower Fish Lake**

The Tier I surveys on Lower Fish Lake revealed 10 distinct plant beds covering approximately 100 acres (Figure 5). A total of thirty-four species were observed before treatment, and thirty-two species were found during the post-treatment survey. Though the species lists from the two surveys differ, emergent and submerged plants dominated the plant beds within Lower Fish Lake before and after treatment. Of the 34 species found pre-treatment, 13 emergent species and 14 submerged species were observed. Six floating species and filamentous algae accounted for the remaining 7 species. After treatment, 15 submerged, 11 emergent species, 5 floating species, and filamentous algae were observed. Lists of all of the plants identified during the Tier I pre-treatment and post-treatment surveys on Lower Fish Lake are summarized in Tables 5 and 6, respectively. Plant abundance ratings are also included in these tables. Appendix A contains copies of the Tier I data sheets from June, while Appendix B contains data sheets from the Tier I survey conducted in August.

### **Bed 01**

Bed 01 encompasses the majority of the eastern shoreline of Lower Fish Lake (Figure 5). It is one of the largest beds on Lower Fish, covering nearly 22 acres. It was also one of the most diverse beds in the lake, containing species representing all three strata (submerged, emergent, and floating plants) during both pre- and post-treatment surveys.

Prior to treatment, Bed 01 contained 21 species. The most dominant species were chara, sago pondweed, and eel grass which all covered 21-60% of the canopy. Filamentous algae, Eurasian watermilfoil, grassy pondweed, and Illinois pondweed were all moderately abundant (2-20%). The remaining 14 species, including curly-leaf pondweed, were all present in low abundance covering less than 2% of the plant bed. Submerged species dominated the bed, accounting for 13 of 21 species found, including the three most dominant plant species. Four emergent species, three floating species, and filamentous algae were also present at the time of the survey. Submerged vegetation covered more than 60% of the plant bed canopy, while floating rooted, emergent, and non-rooted floating vegetation all covered less than 2% of the canopy.

Following treatment, Bed 01 contained 24 species. Again, chara and eel grass dominated the community with greater than 60% canopy cover. Sago pondweed, filamentous algae, slender naiad, spiny naiad, grassy pondweed, and Illinois pondweed were moderately abundant (2-20%). Curly-leaf pondweed was observed in low abundance (<2%) and Eurasian watermilfoil was not detected. Submerged species again dominated the bed comprising 13 of 24 species. Seven emergent species were also identified. Three floating species and filamentous algae were also present at the time of the survey. The percentages of canopy covered by the three strata (submerged, emergent, and floating) were identical to pre-treatment.

**Table 5. Lower Fish Lake Pre-treatment Tier I survey results, June 6, 2006.**

Scientific Name	Common Name	Stratum	Bed 1	Bed 2	Bed 3	Bed 4	Bed 5	Bed 6	Bed 7	Bed 8	Bed 9	Bed 10
<i>Ceratophyllum demersum</i>	Coontail	Submergent	<2%	<2%	--	--	--	--	--	--	--	--
<i>Chara species</i>	Chara species	Submergent	21-60%	<2%	2-20%	21-60%	<2%	>60%	21-60%	21-60%	21-60%	21-60%
<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent	<2%	<2%	--	<2%	2-20%	<2%	<2%	<2%	--	--
<i>Elodea canadensis</i>	Common water weed	Submergent	<2%	--	--	--	--	--	--	--	--	--
<i>Filamentous algae</i>	Filamentous algae	Algae	2-20%	<2%	<2%	<2%	<2%	<2%	2-20%	<2%	<2%	<2%
<i>Heteranthera dubia</i>	Water star grass	Emergent	--	--	--	--	--	--	--	--	--	<2%
<i>Iris virginica</i>	Iris	Emergent	--	--	--	--	--	--	--	<2%	--	--
<i>Lemna minor</i>	Common duckweed	Floating	<2%	--	<2%	<2%	<2%	--	--	<2%	<2%	<2%
<i>Lemna trisulca</i>	Star duckweed	Floating	--	--	<2%	--	--	--	--	--	--	--
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	<2%	--	--	--	<2%	<2%	--	<2%	<2%	<2%
<i>Myosotis scorpioides</i>	True forget-me-not	Emergent	--	--	--	--	--	<2%	<2%	--	--	--
<i>Myriophyllum exalbescens</i>	Northern watermilfoil	Submergent	<2%	--	--	<2%	--	--	--	--	--	--
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent	2-20%	<2%	>60%	<2%	2-20%	<2%	21-60%	2-20%	21-60%	2-20%
<i>Najas species</i>	Naiad species	Submergent	<2%	--	--	<2%	--	--	--	--	--	--
<i>Najas marina</i>	Spiny naiad	Submergent	--	--	--	--	<2%	--	--	--	--	--
<i>Nuphar advena</i>	Spatterdock	Floating	<2%	--	--	--	<2%	2-20%	--	--	--	2-20%
<i>Nuphar variegatum</i>	Bullhead lily	Floating	--	--	--	--	--	2-20%	<2%	21-60%	21-60%	21-60%
<i>Nymphaea tuberosa</i>	White water lily	Floating	<2%	--	--	<2%	21-60%	2-20%	2-20%	2-20%	<2%	2-20%
<i>Peltandra virginica</i>	Arrow arum	Emergent	<2%	<2%	--	<2%	2-20%	<2%	<2%	<2%	<2%	2-20%
<i>Phalaris arundinacea</i>	Reed canary grass	Emergent	--	--	--	<2%	<2%	--	--	<2%	<2%	<2%
<i>Phragmites australis</i>	Common reed	Emergent	--	--	--	--	--	<2%	--	--	--	--
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	<2%	<2%	<2%	--	2-20%	<2%	<2%	<2%	<2%	<2%
<i>Potamogeton foliosus</i>	Narrow leaf pondweed	Submergent	<2%	<2%	--	--	<2%	--	--	--	--	<2%
<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent	2-20%	<2%	--	--	<2%	--	--	--	--	<2%
<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent	2-20%	2-20%	2-20%	2-20%	<2%	2-20%	2-20%	2-20%	2-20%	2-20%
<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent	21-60%	2-20%	<2%	2-20%	<2%	2-20%	21-60%	2-20%	2-20%	2-20%

Scientific Name	Common Name	Stratum	Bed 1	Bed 2	Bed 3	Bed 4	Bed 5	Bed 6	Bed 7	Bed 8	Bed 9	Bed 10
<i>Rosa palustris</i>	Swamp rose	Emergent	--	<2%	--	--	--	--	--	--	--	--
<i>Scirpus validus</i>	Softstem bulrush	Emergent	--	--	--	--	--	--	--	--	--	<2%
<i>Sparganium americanum</i>	American burreed	Emergent	--	--	--	--	<2%	--	--	--	--	--
<i>Spirodela polytricha</i>	Large duckweed	Floating	--	--	--	--	<2%	--	--	--	--	--
<i>Typha angustifolia</i>	Narrow leafed cattail	Emergent	--	--	--	<2%	--	--	--	--	--	--
<i>Typha latifolia</i>	Broad leafed cattail	Emergent	<2%	--	--	--	<2%	--	--	--	--	<2%
<i>Utricularia vulgaris</i>	Common bladderwort	Submergent	<2%	--	--	<2%	--	--	<2%	<2%	<2%	<2%
<i>Valisneria americana</i>	Eel grass	Submergent	21-60%	<2%	--	2-20%	<2%	<2%	2-20%	2-20%	<2%	2-20%

Table 6. Lower Fish Lake Post-treatment Tier I survey results, August 14, 2006.

Scientific Name	Common Name	Stratum	Bed 1	Bed 2	Bed 3-4	Bed 5	Bed 6	Bed 7	Bed 8	Bed 9	Bed 10
<i>Ceratophyllum demersum</i>	Coontail	Submergent	<2%	<2%				<2%	<2%	<2%	<2%
<i>Chara species</i>	Chara species	Submergent	21-60%	2-20%	21-60%	2-20%	21-60%	21-60%		21-60%	21-60%
<i>Cornus obliqua</i>	Silky dogwood	Emergent				<2%					
<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent	<2%	<2%	<2%	<2%	<2%	<2%	<2%		<2%
<i>Filamentous algae</i>	Filamentous algae	Algae	2-20%		<2%	2-20%			<2%	<2%	<2%
<i>Iris virginica</i>	Blue-flag iris	Emergent							<2%		
<i>Leersia Oryzoides</i>	Rice cut grass	Emergent				<2%					
<i>Lemna minor</i>	Common duckweed	Floating			<2%	<2%					
<i>Lythrum salicaria</i>	Purple loosestrife	Emergent	<2%	<2%	<2%	<2%	<2%		<2%	<2%	<2%
<i>Myriophyllum exalhevans</i>	Northern watermilfoil	Submergent	<2%	<2%	<2%	<2%	<2%	<2%	2-20%	<2%	<2%
<i>Myriophyllum heterophyllum</i>	Various leaved watermilfoil	Submergent	<2%		<2%		<2%	<2%		<2%	<2%
<i>Najas flexilis</i>	Slender naiad	Submergent	2-20%	<2%	<2%		<2%				
<i>Najas guadalupensis</i>	Southern naiad	Submergent	<2%	<2%	2-20%						
<i>Najas marina</i>	Spiny naiad	Submergent	2-20%	2-20%	2-20%	2-20%	<2%	2-20%	2-20%	<2%	
<i>Nuphar advena</i>	Spatterdock	Floating	<2%		<2%	2-20%	2-20%	<2%			<2%
<i>Nuphar variegatum</i>	Bullhead lily	Floating	<2%		<2%		2-20%		2-20%	2-20%	2-20%



Scientific Name	Common Name	Stratum	Bed 1	Bed 2	Bed 3-4	Bed 5	Bed 6	Bed 7	Bed 8	Bed 9	Bed 10
<i>Nymphaea tuberosa</i>	White water lily	Floating	<2%		<2%	2-20%	2-20%	<2%	<2%	<2%	<2%
<i>Peltandra virginica</i>	Arrow arum	Emergent	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%	<2%
<i>Phalaris arundinacea</i>	Reed canary grass	Emergent	<2%			<2%	<2%		<2%		
<i>Potamogeton berchtoldii</i>	Broad-leaved small pondweed	Submergent			<2%			<2%			
<i>Potamogeton crispus</i>	Curly-leaf pondweed	Submergent	<2%								
<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent	2-20%	2-20%	2-20%	<2%	2-20%	2-20%	2-20%		<2%
<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent	2-20%	2-20%	2-20%	2-20%	2-20%	2-20%	2-20%	2-20%	<2%
<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent	2-20%	<2%	2-20%	2-20%	2-20%	2-20%	21-60%	<2%	<2%
<i>Scirpus validus</i>	Softstem bulrush	Emergent	<2%								<2%
<i>Sparganium americanum</i>	American burreed	Emergent				<2%					
<i>Sparganium eurycarpum</i>	Common burreed	Emergent	<2%				<2%				
<i>Spirodela polyrrhiza</i>	Large duckweed	Floating			<2%	<2%					
<i>Typha latifolia</i>	Broad leafed cattail	Emergent	<2%		<2%	<2%					<2%
<i>Utricularia gibba</i>	Humped bladderwort	Submergent				<2%					<2%
<i>Utricularia vulgaris</i>	Common bladderwort	Submergent	<2%	<2%	<2%	2-20%	2-20%			<2%	
<i>Valisneria americana</i>	Eel grass	Submergent	21-60%	<2%	2-20%	<2%	<2%	2-20%	2-20%	2-20%	2-20%

### Bed 02

Bed 02 is a small (approximately 2.5 acre), narrow bed located along the southeastern shoreline and adjacent to the southern portion of Bed 01 (Figure 5). Submerged and emergent vegetation dominated this bed during both pre- and post-treatment surveys.

Prior to treatment, Bed 02 contained 13 species. Illinois pondweed and sago pondweed were the dominant species (though only moderately abundant) each covering 2-20% of the bed. All of the remaining species detected, including Eurasian water-milfoil and curly-leaf pondweed, were present in low abundance (<2%). Submerged species dominated the bed accounting for 9 of the 13 species. Three emergent species and filamentous algae were also identified. Submerged vegetation covered 2-20% of the plant bed canopy, while floating rooted, emergent, and non-rooted floating vegetation all covered less than 2% of the canopy.

Following treatment, 13 species were again detected in Bed 02. Chara, spiny naiad, grassy pondweed, and Illinois pondweed were the dominant species (though only moderately abundant) with each species covering 2-20% of the bed. The remaining nine species all covered less than 2%. Curly-leaf pondweed and Eurasian watermilfoil were both absent from the post-treatment survey. Submerged species dominated the bed accounting for 10 of the 13 species. The three remaining species detected were all emergent plants. The percentages of canopy covered by the three strata (submerged, emergent, and floating) were identical to pre-treatment.

### Beds 03 and 04

Beds 03 and 04 were identified as distinct plant beds and detailed separately during the pre-treatment survey. Bed 03 is located in the southern portion of the lake. Only a small part of the bed includes the shoreline; the majority of this nearly 13 acre bed extends into the south-central portion of Lower Fish Lake (Figure 5). At 17 acres, Bed 04 is one of the largest plant beds in Lower Fish. Bed 04 included nearly the entire southern half of Lower Fish Lake's western shoreline (Figure 5). During the post-treatment survey, no Eurasian watermilfoil was identified in Bed 03. As this was the primary distinguishing factor in separating these beds during the pre-treatment survey, JFNew determined that these two beds should be combined and sampled together during the post-treatment assessment. When combined, Beds 03 and 04 total 30 acres and become the largest single plant bed on the lake. Beds 03 and 04 contained species representing all three strata (submerged, emergent, and floating plants) in both pre- and post-treatment surveys.

Prior to treatment, Bed 03 contained eight species. Eurasian watermilfoil was dominant covering more than 60% of the plant bed. Chara and Illinois pondweed were moderately abundant (2-20%). The remaining five species, including curly-leaf pondweed, were all present in low abundance (<2%). Submerged species dominated the bed accounting for five of the eight species. Two floating plant species and filamentous algae were also present. Submerged vegetation covered more than 60% of the plant bed canopy, while floating rooted, emergent, and non-rooted floating vegetation all covered less than 2% of the canopy.

Bed 04 contained 15 species during the pre-treatment survey. Chara was the dominant species covering 21-60% of the bed. Illinois pondweed, sago pondweed, and eel grass were present in moderate abundance (2-20%). The remaining 11 species, including Eurasian watermilfoil, were present in low abundance (<2%). Curly-leaf pondweed was not identified. Submerged species also dominated this bed accounting for 8 of 15 species. Four emergent species, two floating species, and

filamentous algae were also detected. Submerged vegetation covered 21-60% of the plant bed canopy, while floating rooted, emergent, and non-rooted floating vegetation all covered less than 2% of the canopy.

The combined post-treatment survey of Beds 03 and 04 included the identification of 22 plants. Chara was the dominant species covering 21-60% of the plant bed. Southern naiad, spiny naiad, grassy pondweed, Illinois pondweed, sago pondweed, and eel grass were also moderately abundant (2-20%). The remaining 15 species were all present in low abundance covering less than 2% of the plant bed. Curly-leaf pondweed and Eurasian watermilfoil were not detected. Submerged species dominated this combined bed accounting for 12 of 22 species. Four emergent species, five floating species, and filamentous algae were also present. Submerged vegetation covered 21-60% of the plant bed canopy, while floating rooted, emergent, and non-rooted floating vegetation all covered less than 2% of the canopy. These percentages of canopy cover were identical to the pre-treatment estimates in Bed 04 and very similar to those in Bed 03.

#### Bed 05

Bed 05 is the smallest plant bed (less than 2.5 acres) on Lower Fish. This bed is located on the western shoreline within Bed 04 and contains the channel which extends west of the lake (Figure 5). Despite its small size, this bed was one of the most diverse beds in the lake containing 20 and 22 species representing all three strata (submerged, emergent, and floating plants) in both pre- and post-treatment surveys, respectively.

Prior to treatment, Bed 05 contained 20 species. White water lily was the dominant species, with 21-61% abundance. Whirled loosestrife, Eurasian water-milfoil, arrow arum, and curly-leaf pondweed were also moderately abundant covering 2-20% of the plant bed. The remaining 15 species were all present in low abundance covering less than 2% of the plant bed. A diverse group of species was detected; nine submerged, six emergent, four floating, and 1 algal species. Floating rooted vegetation dominated the plant bed canopy (21-60%), submerged and emergent plants comprised 2-20% of the bed, and non-rooted floating vegetation covered less than 2%.

After treatment, Bed 05 contained 22 species. Chara, filamentous algae, spiny naiad, spatterdock, white water lily, Illinois pondweed, sago pondweed, and common bladderwort were co-dominant, each present in moderate abundance (2-20%). The remaining 14 species were all present in low abundance covering less than 2% of the plant bed. Eurasian watermilfoil and curly-leaf pondweed were both absent from the bed. As in the pre-treatment survey, a diverse group of species was detected: nine submerged, eight emergent, four floating, and 1 algal species. Submerged vegetation dominated the plant canopy (31-60%), floating rooted plants covered 2-20%, and emergent and non-rooted floating vegetation covered less than 2%.

#### Bed 06

Bed 06 is approximately 6 acres in size and is located immediately north of Bed 04 on the west side of the lake. The bed begins on the western shoreline of Lower Fish and extends out to the middle of the lake. Bed 06 contained species representing all three strata (submerged, emergent, and floating plants) during both pre- and post-treatment surveys.

Prior to treatment, Bed 06 contained 15 species. Chara was the dominant plant species (>60%). Spatterdock, bullhead lily, white water lily, Illinois pondweed, and sago pondweed were all present in

moderate abundance covering 2-20% of the canopy. The nine remaining species, including Eurasian watermilfoil and curly-leaf pondweed, were all present in low abundance covering less than 2% of the bed. Species contained in this bed were evenly distributed among the strata: six submerged species, five emergent species, three floating species, and filamentous algae were present. Submerged vegetation dominated the plant canopy (60%), floating rooted plants covered 21-60%, and emergent and non-rooted floating vegetation covered less than 2%.

After treatment, Bed 06 contained 18 species. Chara was once again dominant covering 21-60% of the canopy. Just as in the pre-treatment survey, spatterdock, bullhead lily, white water lily, Illinois pondweed, and sago pondweed were all present in moderate abundance covering 2-20% of the canopy. In addition, grassy pondweed and common bladderwort were also moderately abundant (2-20%). The remaining 10 species were all present in low abundance covering less than 2% of the bed. Eurasian watermilfoil and curly-leaf pondweed were both absent from the bed. Submerged species dominated Bed 06 accounting for 10 of the 18 species. Five emergent and three floating species were also present at the time of the survey. Submerged and floating rooted plants dominated the plant canopy covering 21-60%, while emergent and non-rooted floating vegetation covered less than 2%.

#### Bed 07

Bed 07 is located along the western shore of Lower Fish Lake (Figure 5) and covers five acres. Though it was dominated by submerged vegetation, this bed contained species representing all three strata (submerged, emergent, and floating plants) during both pre- and post-treatment surveys.

Prior to treatment, Bed 07 contained 13 species. Chara, Eurasian watermilfoil, and sago pondweed were the dominant species covering 21-60% of the bed. Filamentous algae, white water lily, Illinois pondweed, and eel grass were all present in moderate abundance (2-20%). The six remaining species, including curly-leaf pondweed, were all present in low abundance covering less than 2% of the bed. Submerged vegetation dominated Bed 07 accounting for 7 of 13 species. Three emergent species, two floating species, and filamentous algae were also present at the time of the survey. Submerged vegetation dominated the canopy of the plant bed (>60%). Rooted floating vegetation covered 2-20% of the plant bed canopy, while non-rooted floating and emergent vegetation covered less than 2%.

After treatment, Bed 07 contained 14 species. Chara was the dominant plant species (21-60%), while spiny naiad, grassy pondweed, Illinois pondweed, sago pondweed, and eel grass were each present in moderate abundance (2-20%). The eight remaining species were all present in low abundance covering less than 2% of the bed. Eurasian watermilfoil and curly-leaf pondweed were both absent from the bed. Submerged vegetation again dominated Bed 07 accounting for 10 of 14 species. Two emergent and two floating species were also present at the time of the survey. Submerged vegetation dominated the canopy of the plant bed (21-60%), while rooted floating, emergent, and non-rooted floating plants covered less than 2% of the plant bed canopy.

#### Bed 08

Bed 08 is located along the northwest shoreline of Lower Fish Lake. The bed covers approximately 4.5 acres and is bordered on the south by Bed 07 and east by Bed 09 (Figure 5). This bed contained species representing all three strata (submerged, emergent, and floating plants) in both pre- and post-treatment surveys.

Prior to treatment, Bed 08 contained 16 species. Chara and bullhead lily were co-dominant covering 21-60% of the canopy. Eurasian watermilfoil, white water lily, Illinois pondweed, sago pondweed, and eel grass were each present in moderate abundance (2-20%). The nine remaining species, including curly-leaf pondweed, were all present in low abundance covering less than 2% of the bed. Seven submerged species, five emergent species, three floating species, and filamentous algae were present at the time of the survey. Floating rooted vegetation dominated the plant bed canopy (>60%), submerged plants comprised 21-60% of the bed, and non-rooted floating and emergent vegetation covered less than 2%.

After treatment, Bed 08 contained 15 species. Sago pondweed was the dominant plant species (21-60%), while northern watermilfoil, spiny naiad, bullhead lily, grassy pondweed, Illinois pondweed, and eel grass were all present in moderate abundance (2-20%). The eight remaining species, including curly-leaf pondweed, were all present in low abundance covering less than 2% of the bed. Eurasian watermilfoil was absent from the bed. Similar to the pre-treatment survey, seven submerged species, five emergent species, two floating species, and filamentous algae were present. Submerged vegetation dominated the plant bed canopy (21-60%), floating rooted plants comprised 2-20% of the bed, and non-rooted floating and emergent vegetation covered less than 2%.

#### Bed 09

Bed 09 is located in the northwest portion of the lake. A small portion of this nearly 16 acre plant bed is located along the shoreline; the rest extends into the middle of the lake (Figure 5). This bed contained species representing all three strata (submerged, emergent, and floating plants) during both pre- and post-treatment surveys.

Prior to treatment, Bed 09 contained 14 species. Chara, Eurasian watermilfoil, and bullhead lily were the dominant species covering 21-60% of the bed. Illinois pondweed and sago pondweed were also present in moderate abundance (2-20%). The nine remaining species, including curly-leaf pondweed, were all present in low abundance covering less than 2% of the bed. Submerged vegetation dominated Bed 09, accounting for 7 of 14 species. Three emergent species, three floating species, and filamentous were also present at the time of the survey. Submerged vegetation dominated the plant bed canopy (21-60%), floating rooted plants comprised 2-20% of the bed, and non-rooted floating and emergent vegetation covered less than 2%.

After treatment, Bed 09 contained 13 species. Chara was the lone dominant species covering 21-60% of the plant bed. Bullhead lily, Illinois pondweed, and eel grass were present in moderate abundance (2-20%). The nine remaining species were all present in low abundance covering less than 2% of the bed. Eurasian watermilfoil and curly-leaf pondweed were absent from the bed. Submerged vegetation dominated Bed 09 accounting for 9 of 13 species. Two emergent and two floating species were also present at the time of the survey. Submerged vegetation dominated the plant bed canopy (21-60%), floating rooted plants comprised 2-20% of the bed, and non-rooted floating and emergent vegetation covered less than 2%.

#### Bed 10

Bed 10 is the northernmost bed in Lower Fish Lake occupying 13 acres along the north shoreline. It was one of the most diverse beds in the lake, containing species representing all three strata (submerged, emergent, and floating plants) during both pre- and post-treatment surveys.

Prior to treatment, Bed 10 contained 20 species. Chara and bullhead lily were co-dominant species (21-60%). Eurasian watermilfoil, spatterdock, white water lily, arrow arum, Illinois pondweed, sago pondweed, and eel grass were all found in moderate abundance covering 2-20% of the plant bed. The 11 remaining species, including curly-leaf pondweed, were all present in low abundance covering less than 2% of the bed. Submerged vegetation dominated Bed 10 accounting for 9 of 20 species. Six emergent species, four floating species, and filamentous algae were also present at the time of the survey. Submerged and floating rooted vegetation dominated the plant bed canopy (21-60%), emergent plants comprised 2-20% of the bed, and non-rooted floating vegetation covered less than 2%.

After treatment, Bed 10 contained 18 species. Chara was the lone dominant species covering 21-60% of the plant bed. Bullhead lily and eel grass were present in moderate abundance (2-20%). The 15 remaining species were all present in low abundance covering less than 2% of the bed. Eurasian watermilfoil and curly-leaf pondweed were absent from the bed. Submerged vegetation dominated Bed 10 accounting for 9 of 18 species. Five emergent species, three floating species, filamentous algae were also present at the time of the survey. Submerged vegetation dominated the plant bed canopy (21-60%), floating rooted plants comprised 2-20% of the bed, and emergent and non-rooted floating vegetation covered less than 2%.

### **Description of Beneficial and Problem Plant Areas**

Upper Fish Lake contained 42 species of plants during both pre-and post-treatment surveys. This diversity is positive for the lake. If invasive species are kept in check, the many beneficial species that remain have the potential to establish healthy, stable plant beds. However, invasive Eurasian watermilfoil and curly-leaf pondweed are still of concern in this lake.

Prior to the 2006 treatment, Eurasian watermilfoil was detected at 2-20% abundance in both Upper Fish Lake beds and the connecting channel. This lake has been treated for Eurasian watermilfoil every year since 2000 (Weed Patrol, 2005). The spring 2006 survey results indicate that both species are still present in Upper Fish Lake. After the 2006 treatment, Eurasian watermilfoil was no longer detected indicating successful seasonal control. Future seasonal treatment will likely be required to suppress this aggressive plant preventing its further spread and attempting to decrease established Eurasian watermilfoil plant stands. Of particular concern is control of Eurasian watermilfoil in areas with heavy boat traffic including the channel connecting Upper and Lower Fish Lakes. Since this plant spreads via fragmentation, its spread is facilitated by boat motors breaking apart the plants and carrying fragments to both lakes.

Curly-leaf pondweed was one of the more dominant species (21-60%) in Bed 01 prior to treatment, and was present in very low abundance in Bed 02 and the connecting channel. However, due to the timing of LARE surveys, surveys were not conducted at the peak of curly-leaf pondweed growth. Rather, an assessment should be conducted in April or early May to adequately quantify the presence and location of curly-leaf pondweed within Upper Fish Lake. The fact that curly-leaf pondweed was still quite dominant in Bed 01 in June does indicate a potentially heavy infestation that will likely require further treatment (this lake has been treated for curly-leaf pondweed every year since 2000 (Weed Patrol, 2005)).



Lower Fish also exhibited a fairly diverse plant community; with 34 species detected before treatment and 32 species found post-treatment. The eastern portion of the lake was dominated by submerged species with floating species sharing (and occasionally dominating) the plant bed canopy along the western shoreline. Chara, sago pondweed, and eel grass were the most dominant plants throughout the lake. Eurasian water milfoil and curly-leaf pondweed are again the species of concern in this lake.

Prior to treatment, Eurasian watermilfoil was dominant in Bed 03 (>60%) and abundant (21-60%) in Beds 07 and 09. It was found in moderate abundance (2-20%) in Beds 01, 05, 08, and 10. This means that the highest densities of Eurasian watermilfoil were found in the southern and northwestern portions of Lower Fish Lake. After treatment, Eurasian watermilfoil was absent from all 10 beds in the lake. Treatment was highly effective at providing seasonal relief. However, the widespread presence and relative abundance of this plant in the spring, even following five previous years of treatment (Weed Patrol, 2005) indicates that future treatment will be required to prevent further spread.

Prior to treatment, curly-leaf pondweed was found in most beds, but was present in very low abundance (<2%). The one exception was Bed 05, where it was found covering 2-20% of the canopy. However, as was the case in Upper Fish, the true extent of curly-leaf pondweed infestation could not be adequately assessed during either survey due its growth pattern. An assessment should be conducted in April or early May to adequately quantify the presence and location of curly-leaf pondweed within Lower Fish Lake.

### **8.2.2 Tier II**

Tier II surveys were completed on Upper and Lower Fish Lakes on August 11, 2006. These surveys were completed at the same time as the summer Tier I surveys and can also be referred to as “post-treatment” surveys (though there is no pre-treatment Tier II data from 2006). Raw Tier II survey data are included in Appendix B. Unfortunately, data collected during these surveys cannot be compared to Tier II data collected in 2004 and 2005. In those earlier surveys, Upper and Lower Fish Lakes were sampled together and the data was combined.

### **Upper Fish Lake**

Transparency measured using a Secchi disk prior to sampling was found to be 4.3 feet at the time of the survey. Based on the survey protocol, plants were sampled to a depth of 20 feet, however, plants were only found to a depth of 15 feet. Fifty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol (see Figure 6). Results of the sampling are listed in Table 7.

Coontail was found at the highest percentage of sites throughout the water column (58%). However, chara had the highest relative and mean densities at all depths (0-15 feet), as well as the highest dominance score (Table 7). Great bladderwort, humped bladderwort, eel grass, southern naiad, and grassy pondweed were also relatively dense throughout the water column, found at 36%, 22%, 20%, 14%, and 12% of sites, respectively (Table 7). Some combination of these seven species dominated in each strata. Filamentous algae was also quite prevalent occurring at sites in every strata and 76% of the total sites sampled. Curly-leaf pondweed was only detected at 4% of the sites and in low densities. Figure 7 documents the sites where curly-leaf pondweed was identified during this survey. Eurasian watermilfoil was not detected.

**Table 7. Upper Fish Lake, post-treatment Tier II survey metrics and data, August 11, 2006.**

County:	LaPorte	Sites with plants:	37	Mean species/site:	2.20
Date:	11-Aug-06	Sites with native plants:	37	Mean native species/site:	2.16
Secchi (ft):	4.3	Number of species:	12	Species diversity:	0.83
Max. plant depth (ft):	15	Number of native species:	11	Native species diversity:	0.83
Trophic status:	eutrophic	Maximum species/site:	6	Rake diversity:	0.75
Total number of sites:	50			Native rake diversity:	0.75
<b>All Depths (0-15 feet)</b>					
<b>Common Name</b>	<b>Scientific Name</b>	<b>Site Frequency</b>	<b>Relative Density</b>	<b>Mean Density</b>	<b>Dominance</b>
Coontail	<i>Ceratophyllum demersum</i>	58.0	1.54	2.66	30.80
Chara	<i>Chara spp.</i>	46.0	1.58	3.43	31.60
Great bladderwort	<i>Utricularia vulgaris</i>	36.0	0.68	1.89	13.60
Humped bladderwort	<i>Utricularia gibba</i>	22.0	0.38	1.73	7.60
Eel grass	<i>Vallisneria americana</i>	20.0	0.20	1.00	4.00
Southern naiad	<i>Najas guadalupensis</i>	14.0	0.14	1.00	2.80
Grassy pondweed	<i>Potamogeton gramineus</i>	12.0	0.12	1.00	2.40
Curly-leaf pondweed	<i>Potamogeton crispus</i>	4.0	0.04	1.00	0.80
Northern watermilfoil	<i>Myriophyllum exalbescent</i>	2.0	0.02	1.00	0.40
Slender naiad	<i>Najas flexilis</i>	2.0	0.02	1.00	0.40
White water crowfoot	<i>Ranunculus longirostris</i>	2.0	0.02	1.00	0.40
Bog bladderwort	<i>Utricularia geminiscapa</i>	2.0	0.02	1.00	0.40
Filamentous algae	<i>Algae</i>	76.0			
<b>Depth: 0-5 feet</b>					
Chara	<i>Chara spp.</i>	100.0	4.00	4.00	80.00
Coontail	<i>Ceratophyllum demersum</i>	71.4	1.00	1.40	20.00
Great bladderwort	<i>Utricularia vulgaris</i>	64.3	1.50	2.33	30.00
Grassy pondweed	<i>Potamogeton gramineus</i>	42.9	0.43	1.00	8.57
Eel grass	<i>Vallisneria americana</i>	35.7	0.36	1.00	7.14
Southern naiad	<i>Najas guadalupensis</i>	28.6	0.29	1.00	5.71
Humped bladderwort	<i>Utricularia gibba</i>	21.4	0.36	1.67	7.14
Slender naiad	<i>Najas flexilis</i>	7.1	0.07	1.00	1.43
Filamentous algae	<i>Algae</i>	100.0			



Common Name	Scientific Name	Site Frequency	Relative Density	Mean Density	Dominance
<b><u>Depth: 5-10 feet</u></b>					
Coontail	<i>Ceratophyllum demersum</i>	78.6	2.21	2.82	44.29
Chara	<i>Chara spp.</i>	42.9	1.14	2.67	22.86
Eel grass	<i>Vallisneria spiralis</i>	35.7	0.36	1.00	7.14
Humped bladderwort	<i>Utricularia gibba</i>	28.6	0.71	2.50	14.29
Great bladderwort	<i>Utricularia vulgaris</i>	21.4	0.21	1.00	4.29
Southern naiad	<i>Najas guadalupensis</i>	14.3	0.14	1.00	2.86
Northern watermilfoil	<i>Myriophyllum exalbescens</i>	7.1	0.07	1.00	1.43
White water crowfoot	<i>Ranunculus longirostris</i>	7.1	0.07	1.00	1.43
Curly-leaf pondweed	<i>Potamogeton crispus</i>	7.1	0.07	1.00	1.43
Filamentous algae	<i>Algae</i>	92.9			
<b><u>Depth: 10-15 feet</u></b>					
Coontail	<i>Ceratophyllum demersum</i>	58.3	2.58	4.43	51.67
Great bladderwort	<i>Utricularia vulgaris</i>	41.7	0.75	1.80	15.00
Humped bladderwort	<i>Utricularia gibba</i>	33.3	0.33	1.00	6.67
Chara	<i>Chara spp.</i>	25.0	0.58	2.33	11.67
Southern naiad	<i>Najas guadalupensis</i>	8.3	0.08	1.00	1.67
Bog bladderwort	<i>Utricularia geminiscapa</i>	8.3	0.08	1.00	1.67
Curly-leaf pondweed	<i>Potamogeton crispus</i>	8.3	0.08	1.00	1.67
Filamentous algae	<i>Algae</i>	83.3		1.00	
<b><u>Depth: 15-20 feet</u></b>					
Coontail	<i>Ceratophyllum demersum</i>	10.0	0.10	1.00	2.00
Great bladderwort	<i>Utricularia vulgaris</i>	10.0	0.10	1.00	2.00
Filamentous algae	<i>Algae</i>	10.0			

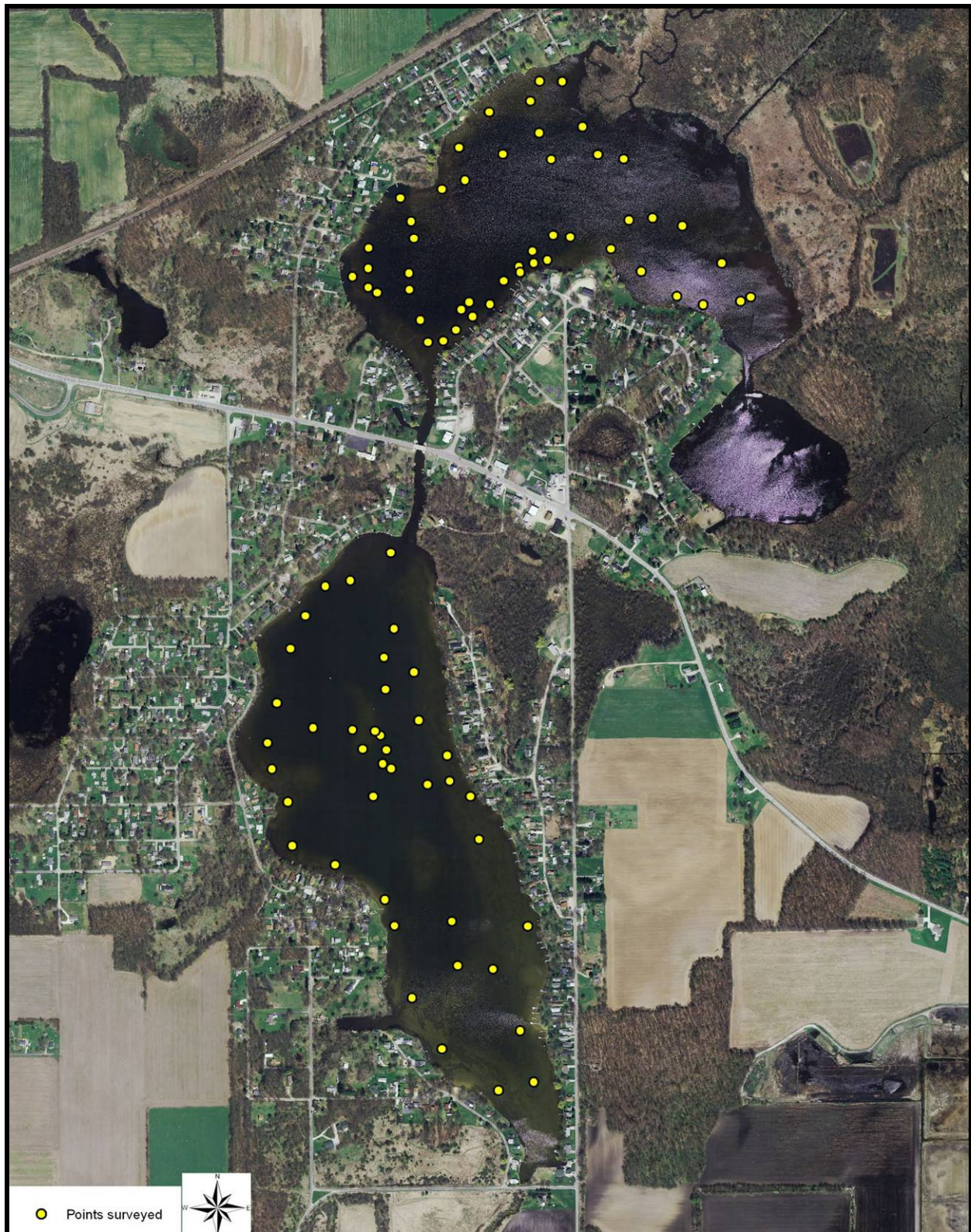


Figure 6. Sampling locations for the August 11, 2006, Tier II Survey, Upper and Lower Fish Lake



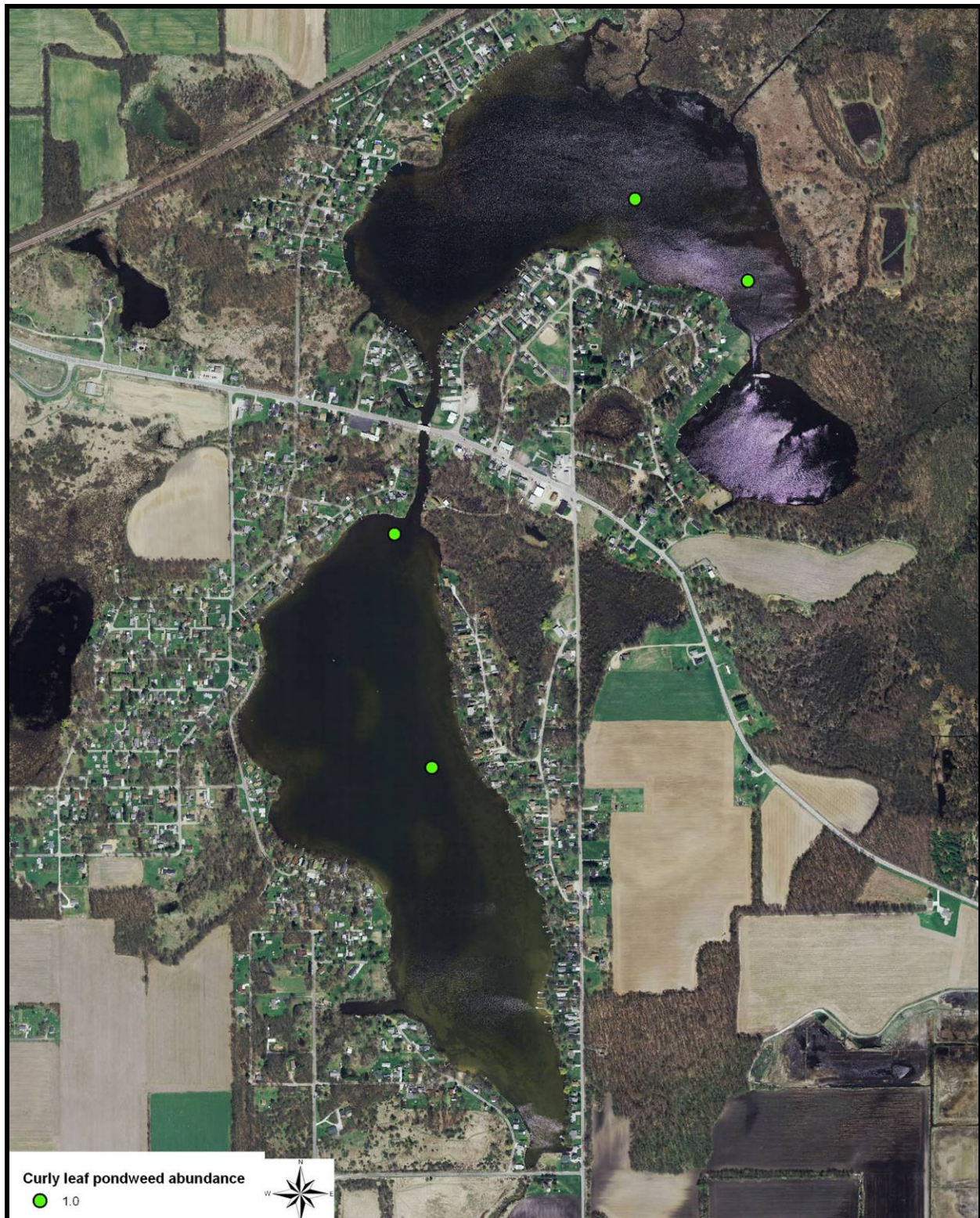


Figure 7. Curly-leaf pondweed locations and densities as surveyed August 11, 2006, Upper and Lower Fish Lake.

Upper Fish Lake possessed greater diversity than the lakes surveyed by Pearson (2004; Table 8). Upper Fish Lake possessed 12 species during the post-treatment survey, while Pearson collected only eight species on average. Upper Fish Lake also possessed more native species (11 compared to Pearson's seven) and greater rake diversity (0.75 compared with 0.62 by Pearson). It should be noted that Pearson study was not intended nor designed to create baseline native aquatic plant data for evaluative purposes, and therefore over-reliance on comparisons to Pearson's data in making management decisions should be avoided.

**Table 8. A comparison of the aquatic plant community in Upper Fish Lake with the average values for plant community metrics found by Pearson (2004) in his survey of 21 northern Indiana lakes.**

	Upper Fish Lake Post-treatment (8/11/06)	Indiana Average 2004
Percentage of littoral sites containing plants	74%	-
Number of species collected	12	8
Number of native species collected	11	7
Rake Diversity (SDI)	0.75	0.62
Native Rake Diversity (SDI)	0.75	0.5
Species Richness (Avg # species/site)	2.20	1.61
Native Species Richness	2.16	1.33
Site Species Diversity	0.83	0.66
Site Species native diversity	0.83	0.56

### Lower Fish Lake

Transparency measured using a Secchi disk prior to sampling was found to be 5 feet at the time of the survey. Based on the survey protocol, plants were sampled to a depth of 20 feet, however, plants were only found to a depth of 15 feet. Fifty sites were randomly selected within the littoral zone based on the stratification indicated in the protocol (see Figure 6). Results of the sampling are listed in Table 9.

Chara was the dominant plant over all depths (0-15 feet) occurring at 46% of all sites. It also had the highest relative density (1.42), mean density (3.09), and dominance score (28.40) of all plants. Grassy pondweed, sago pondweed, eel grass, coontail, spiny naiad, and southern naiad were also found relatively frequently, discovered at 30%, 30%, 28%, 18%, 18%, and 12%, respectively. Chara dominated the 0-5 and 5-10 foot strata and shared dominance with coontail in the 10-15 foot strata. Filamentous algae was also quite prevalent, occurring at sites in every strata and 54% of total sites sampled. Curly-leaf pondweed was only detected at 4% of the sites and in low densities. Figure 7 documents the sites where curly-leaf pondweed was identified during this survey. Eurasian watermilfoil was not detected.



**Table 9. Lower Fish Lake, post-treatment Tier II survey metrics and data, August 11, 2006.**

County:	LaPorte	Sites with plants:	33	Mean species/site:	2.12
Date:	11-Aug-06	Sites with native plants:	32	Mean native species/site:	2.08
Secchi (ft):	5	Number of species:	14	Species diversity:	0.87
Max. plant depth (ft):	15	Number of native species:	13	Native species diversity:	0.87
Trophic status:	mesotrophic	Maximum species/site:	5	Rake diversity:	0.81
Total number of sites:	50			Native rake diversity:	0.81
<b>All Depths (0-15 feet)</b>					
<b>Common Name</b>	<b>Scientific Name</b>	<b>Site Frequency</b>	<b>Relative Density</b>	<b>Mean Density</b>	<b>Dominance</b>
Chara	<i>Chara spp.</i>	46.0	1.42	3.09	28.40
Grassy pondweed	<i>Potamogeton gramineus</i>	30.0	0.38	1.27	7.60
Sago pondweed	<i>Stuckenia pectinatus</i>	30.0	0.38	1.27	7.60
Eel grass	<i>Vallisneria americana</i>	28.0	0.40	1.43	8.00
Coontail	<i>Ceratophyllum demersum</i>	18.0	0.34	1.89	6.80
Spiny naiad	<i>Najas marina</i>	18.0	0.46	2.56	9.20
Southern naiad	<i>Najas guadalupensis</i>	12.0	0.16	1.33	3.20
Two-leaf watermilfoil	<i>Myriophyllum heterophyllum</i>	6.0	0.06	1.00	1.20
Slender naiad	<i>Najas flexilis</i>	6.0	0.06	1.00	1.20
Narrow-leaf pondweed	<i>Potamogeton folioxis</i>	4.0	0.08	2.00	1.60
Illinois pondweed	<i>Potamogeton illinoensis</i>	4.0	0.04	1.00	<b>0.80</b>
Common bladderwort	<i>Utricularia vulgaris</i>	4.0	0.04	1.00	0.80
Curly-leaf pondweed	<i>Potamogeton crispus</i>	4.0	0.04	1.00	0.80
Northern watermilfoil	<i>Myriophyllum exalbesces</i>	2.0	0.02	1.00	0.40
Filamentous algae	<i>Algae</i>	54.0			
<b>Depth: 0-5 feet</b>					
Chara	<i>Chara spp.</i>	71.4	2.57	3.60	51.43
Grassy pondweed	<i>Potamogeton gramineus</i>	57.1	0.86	1.50	17.14
Sago pondweed	<i>Stuckenia pectinatus</i>	57.1	0.86	1.50	17.14
Eel grass	<i>Vallisneria americana</i>	50.0	0.50	1.00	10.00
Spiny naiad	<i>Najas marina</i>	35.7	1.07	3.00	21.43
Southern naiad	<i>Najas guadalupensis</i>	21.4	0.21	1.00	4.29
Coontail	<i>Ceratophyllum demersum</i>	14.3	0.14	1.00	2.86
Slender naiad	<i>Najas flexilis</i>	14.3	0.14	1.00	2.86

<b>Depth: 0-5 feet (cont.)</b>						
<b>Common Name</b>	<b>Scientific Name</b>	<b>Site Frequency</b>	<b>Relative Density</b>	<b>Mean Density</b>	<b>Dominance</b>	
Illinois pondweed	<i>Potamogeton illinoensis</i>	14.3	0.14	1.00	2.86	
Common bladderwort	<i>Utricularia vulgaris</i>	14.3	0.14	1.00	2.86	
Northern watermilfoil	<i>Myriophyllum exalbescent</i>	7.1	0.07	1.00	1.43	
Filamentous algae	<i>Algae</i>	64.3				
<b>Depth: 5-10 feet</b>						
Chara	<i>Chara spp.</i>	78.6	2.07	2.64	41.43	
Sago pondweed	<i>Stuckenia pectinatus</i>	42.9	0.43	1.00	8.57	
Grassy pondweed	<i>Potamogeton gramineus</i>	35.7	0.36	1.00	7.14	
Eel grass	<i>Vallisneria americana</i>	35.7	0.79	2.20	15.71	
Coontail	<i>Ceratophyllum demersum</i>	21.4	0.64	3.00	12.86	
Southern naiad	<i>Najas guadalupensis</i>	21.4	0.36	1.67	7.14	
Spiny naiad	<i>Najas marina</i>	21.4	0.50	2.33	10.00	
Two-leaf watermilfoil	<i>Myriophyllum heterophyllum</i>	14.3	0.14	1.00	2.86	
Slender naiad	<i>Najas flexilis</i>	7.1	0.07	1.00	1.43	
Narrow-leaf pondweed	<i>Potamogeton foliosus</i>	7.1	0.21	3.00	4.29	
Curly-leaf pondweed	<i>Potamogeton crispus</i>	7.1	0.07	1.00	1.43	
Filamentous algae	<i>Algae</i>	78.6		1.36		
<b>Depth: 10-15 feet</b>						
Coontail	<i>Ceratophyllum demersum</i>	33.3	0.50	1.50	10.00	
Chara	<i>Chara spp.</i>	16.7	0.50	3.00	10.00	
Grassy pondweed	<i>Potamogeton gramineus</i>	16.7	0.17	1.00	3.33	
Eel grass	<i>Vallisneria americana</i>	16.7	0.17	1.00	3.33	
Two-leaf watermilfoil	<i>Myriophyllum heterophyllum</i>	8.3	0.08	1.00	1.67	
Spiny naiad	<i>Najas marina</i>	8.3	0.08	1.00	1.67	
Narrow-leaf pondweed	<i>Potamogeton foliosus</i>	8.3	0.08	1.00	1.67	
Sago pondweed	<i>Stuckenia pectinatus</i>	8.3	0.08	1.00	1.67	
Curly-leaf pondweed	<i>Potamogeton crispus</i>	8.3	0.08	1.00	1.67	
Filamentous algae	<i>Algae</i>	58.3				
<b>Depth: 15-20 feet</b>						
Filamentous algae	<i>Algae</i>	2.0				

Like Upper Fish Lake, Lower Fish Lake possessed greater diversity than the lakes surveyed by Pearson (2004; Table 10). Lower Fish Lake possessed 14 species during the post-treatment survey, while Pearson collected only eight species on average. Lower Fish Lake also possessed more native species (13 compared to Pearson's seven) and greater rake diversity (0.81 compared with 0.62 by Pearson). As mentioned earlier, caution should be practiced when using comparisons to Pearson's data for the purpose of making management decisions as the design of Pearson's study was not intended for the establishment of baseline data.

**Table 10. A comparison of the aquatic plant community in Lower Fish Lake with the average values for plant community metrics found by Pearson (2004) in his survey of 21 northern Indiana lakes that ranged from 12 to 774 surface acres in size with maximum littoral depths from 0.7 to 23.3 ft.**

	<b>Lower Fish Lake Post-treatment (8/11/06)</b>	<b>Indiana Average 2004</b>
Percentage of littoral sites containing plants	66%	-
Number of species collected	14	8
Number of native species collected	13	7
Rake Diversity (SDI)	0.81	0.62
Native Rake Diversity (SDI)	0.81	0.5
Species Richness (Avg # species/site)	2.12	1.61
Native Species Richness	2.08	1.33
Site Species Diversity	0.87	0.66
Site Species native diversity	0.87	0.56

### **Aquatic Vegetation Sampling Discussion**

The primary focus of an aquatic vegetation management plan is to document changes within the aquatic plant community and to develop plans for future work. Curly-leaf pondweed and Eurasian watermilfoil were the two exotic species targeted in the herbicide treatments that occurred on June 8 and August 9, 2006. There were only two beds (one in each lake) where curly-leaf pondweed was detected at an abundance greater than 2% bed cover during the pre-treatment Tier I surveys. In both of these beds, curly-leaf pondweed abundance decreased in the post-treatment surveys. The post-treatment Tier II surveys in both lakes confirmed that curly-leaf pondweed was sparse, occurring in only 4% of sites sampled in each lake and at low densities. However, the true impact of the treatment on curly-leaf pondweed populations remains elusive as curly-leaf pondweed density naturally declines in the summer due to increased water temperatures.

Pre-and post-treatment Tier I data indicate that chemical treatment had a dramatic impact on Eurasian watermilfoil in both Upper and Lower Fish Lakes. Prior to treatment, Eurasian watermilfoil was present in all beds in both lakes and the connecting channel, albeit in varying degrees of abundance. After treatment, Eurasian watermilfoil was not detected at any of the beds in either lake in the Tier I surveys including the three beds in Lower Fish where it had previously covered more than 21% of the canopy. It was not detected at any sites during the post-treatment Tier II survey, either. It should be noted, however, that these lakes have been treated annually for several years, with Eurasian watermilfoil always returning in subsequent years. So, these dramatic results likely only represent seasonal relief.

It is very difficult to reach any conclusions about the response of the native plant community to the 2006 herbicide applications. There is not a noticeable trend of change in the number of species detected in pre- and post-treatment Tier I surveys. In most beds, these numbers were quite similar. In some beds, the most dominant species remained the same while in others the species compositions changed dramatically. A plethora of seasonal and temporal variables make it impossible to prove any sort of cause and effect relationship. Variables that may be masking the true effect of the herbicide application include the seasonal variation in plant biomass and natural variations of the plant community throughout the littoral zone. Other temporal variables that may be impacting upon plant bed composition include increased boat traffic, predation and physical stressors such as increased temperatures as the season progressed.

### **8.3 Macrophyte Inventory Discussion**

Since the spatial variables impacting the plant community, such as boat-traffic and changes in nutrient availability, or for temporal variables such as climactic (temperature or precipitation) conditions, cannot be determined, an exact and accurate analysis regarding the impact of herbicide treatment upon the Fish Lakes' aquatic plant communities are not possible. Additionally, data analysis is complicated by the fact that 1) no "control" data exists from a year without herbicide treatment; 2) Tier I beds sampled in 2006 do not correspond to those sampled in 2005, preventing accurate comparison; and 3) 2006 Tier II survey data cannot accurately be compared to data from previous years, when the Fish Lakes were treated as a single lake and sampled together.

We do know that Eurasian watermilfoil treatment has occurred annually since 2000 with treatment areas ranging from 42 to 92 acres (Weed Patrol, 2005). Though it is impossible to conclude the exact impacts these treatments have had on the size or density of Eurasian watermilfoil beds, it is clear that they have not been successful in reducing the necessary treatment area. Eighty acres were treated in June 2006 and nine acres were treated again in August 2006. Even if herbicide treatments are successful in reducing the current infestations, new plants will likely be established from fragments entering Upper Fish Lake via Mill Creek unless upstream populations of Eurasian watermilfoil are controlled as well.

Similar statements can be made about curly-leaf pondweed. Sixty acres were treated in June 2006; the same acreage treated in 2000 (Weed Patrol, 2005). As discussed earlier, a probable explanation for a lack of response to treatment is that at least some of the treatments (including the 2006 treatment) occurred too late in the growing season: turions had already formed, thus ensuring the following year's population. To best assess the true extent of the curly-leaf pondweed infestation and most effectively treat it, both assessment and treatment should occur early in the growing season when water temperatures are 30 to 40°.

It is difficult to determine how the native aquatic plant communities within the Fish Lakes are responding to herbicide treatment, as we cannot directly compare the 2006 data with data collected in previous surveys. That said it is interesting to note that the 2006 post-treatment Tier II surveys detected more native species in each of the lakes than had been recorded during any previous survey of the two lakes combined. In 2006, Upper and Lower Fish Lakes had 11 and 13 native species, respectively. Previous combined surveys from fall 2004, spring 2005, and fall 2005 detected 10, 5, and 7 native species, respectively. So, it can be hypothesized that perhaps the repeated chemical



treatments are positively impacting native plants allowing them to better compete with exotics in the Fish Lakes. However, this hypothesis cannot be proven with the data currently available.

### **9.0 Aquatic Vegetation Management Alternatives**

No new aquatic vegetation management alternatives are available for discussion that have not been covered by previous plans. Consult the original aquatic plant management plan completed by Weed Patrol in 2005 for more information on management alternatives.

### **10.0 Public Involvement**

The LARE biologist, district fisheries biologist, and a representative from the contracted herbicide applicator met November 30, 2006 to discuss the 2006 aquatic plant treatment and identify aquatic plant treatment options for 2007. From this meeting, it was determined that the following would occur:

1. All areas identified as possessing dense Eurasian watermilfoil beds should be treated in 2007.
2. Efforts to adequately catalog the curly-leaf pondweed community with early season surveys should also occur. Treatment is recommended but may not be reimbursed by the LARE program in 2007.
3. A plan for assessment and treatment of Eurasian watermilfoil in areas upstream of Fish Lake should occur.

Based on this information, a grant application to treat 80 acres of Eurasian watermilfoil and 60 acres of curly-leaf pondweed will be submitted to the LARE program staff (Figures 8 and 9). The FLCD should determine how best to contract for curly-leaf pondweed work independent of the LARE program. This includes budgeting for this treatment on their own, if necessary, and handling the contracting efforts through an open bid process. If it is deemed feasible, the LARE program will reimburse FLCD for curly-leaf pondweed treatments if, and only if, the curly-leaf pondweed treatment occurs through an open-bidding process, the process is documented, and a copy of the signed contract and the files and responses used to document the bidding process are on file in the LARE office prior to treatment occurring.

The effort to identify outside funding opportunities for curly-leaf pondweed arose from funding limitations within the LARE program in 2006 that required prioritization of the most aggressive exotic species. Curly-leaf pondweed tends to senesce during the height of the summer recreational season compared to Eurasian watermilfoil, which interferes with recreation throughout the year. In order to cut approximately \$300,000 of funding requests, the decision was made to not fund curly-leaf pondweed treatments. However, funding for curly-leaf pondweed in lakes where that species is the primary species of concern or where it can be treated simultaneously with Eurasian watermilfoil may be considered in the future.

The public meeting for the aquatic plant management plan occurred in concert with a series of other meetings on October 21, 2006. During this larger meeting, the LARE program in general and the aquatic plant management program specifically were discussed. Attendees were provided with the LARE survey form to fill out in order for attendees to provide their thoughts on aquatic plant densities, previous aquatic plant management treatments, and future treatment needs and efforts within Fish Lake. All of the polled individuals indicated that aquatic plant growth is at nuisance levels and agreed that vegetation control efforts should continue.



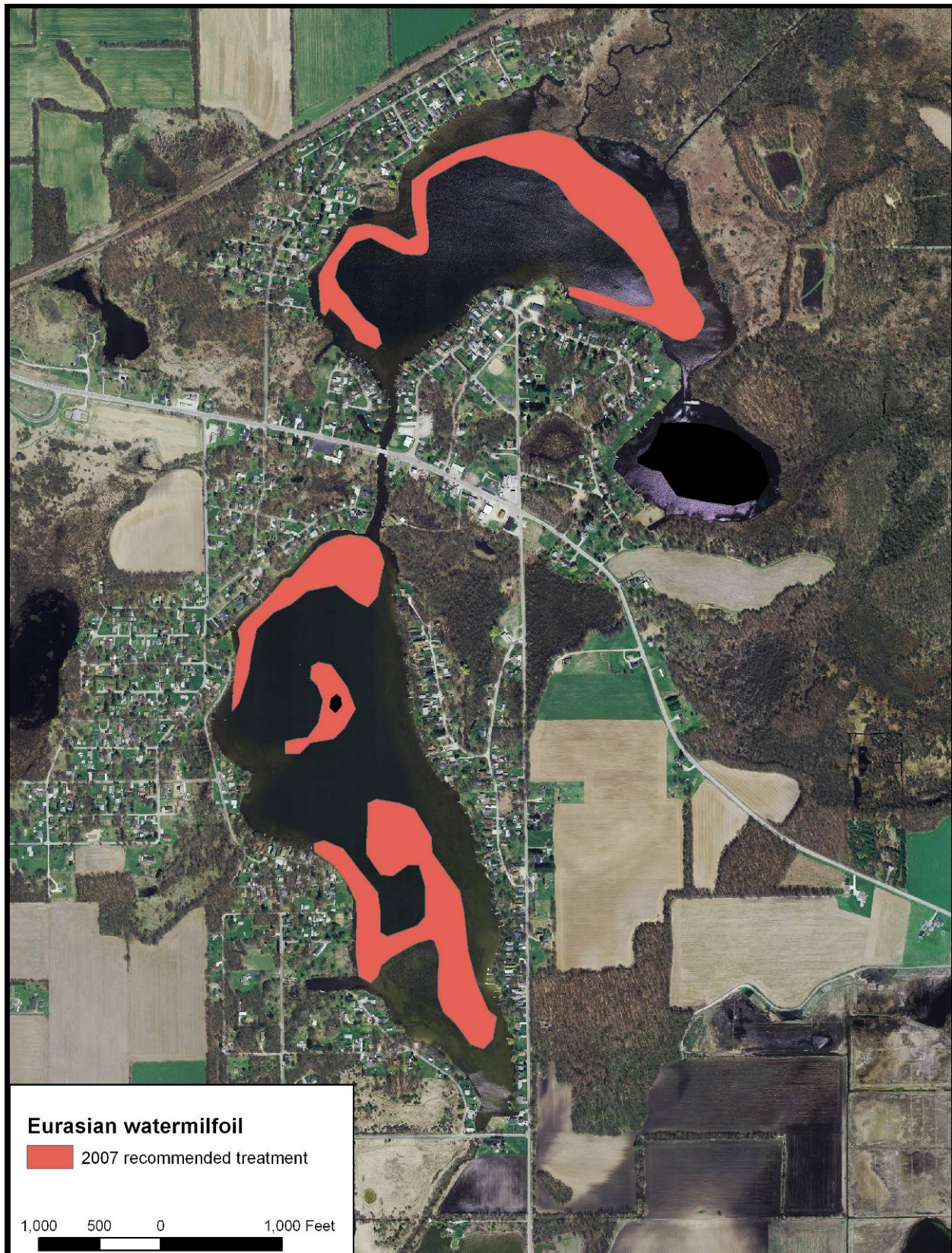


Figure 8. Recommended Eurasian watermilfoil treatment areas for 2007.





Figure 9. Recommended curly-leaf pondweed treatment areas for 2007.



### **11.0 Public Education**

Future public education efforts associated with the Fish Lake Aquatic Plant Management Plan follow efforts identified during the initial Fish Lake Aquatic Plant Management Plan. These items are not repeated herein. There is however, an additional species of concern that was identified in Lake Manitou (Fulton County) in 2006. This species is hydrilla, which is an extremely aggressive submerged aquatic plant species that looks similar to common elodea. The basic difference is the number of leaves: hydrilla contains five leaves while common elodea only contains three leaves. Appendix C contains more detailed information non hydrilla, its habitat, and its distribution. Efforts to education individuals on the control, spread, and issues associated with this and other exotic species should follow the Stop the Hitchhikers! Campaign which can be found at [www.protectyourwaters.net](http://www.protectyourwaters.net). At a minimum, the FLCD should post warnings and send information to all members of the FLCD about this plant.

### **12.0 Integrated Management Action Strategy**

Post-treatment surveys suggest that seasonal control of Eurasian watermilfoil was extremely successful in 2006. However, based on previous treatment history in these lakes, it is likely that the same areas will be infested with Eurasian watermilfoil again in 2007. Treatment of all areas of Eurasian watermilfoil identified in Figure 8 is recommended for 2007. This includes approximately 80 acres of Eurasian watermilfoil treatment. Eurasian watermilfoil should be treated with either 2,4-D or Renovate-3 at a rate determined during the 2007 pre-treatment assessment (Tony Cunningham, Weed Patrol, personal communication). In areas less than 5 acres in size, granular rather liquid herbicide should be used in order to generate adequate coverage and targeted treatment rates. It is also recommended that the FLCD coordinate early season assessment and treatment of 60 acres of curly-leaf pondweed as identified above and in Figure 9. A permit for aquatic plant treatment within Upper and Lower Fish Lakes is included in Appendix D. These assessments should occur when water temperatures are at 30 to 40° F so that treatment may occur within this water temperature range as well. Additionally, assessment of the areas upstream of Fish Lake is necessary to determine whether treatment of these areas will diminish reinfestation by Eurasian watermilfoil again in the future. Once it is determined whether these areas are acting as nurseries for Eurasian watermilfoil, a successful plan to reduce the growth of this species in these locations should be identified.

### **13.0 Project Budget**

Costs for aquatic plant assessment and treatment in 2007 are as follows:

- Eurasian watermilfoil treatment of approximately 80 acres at a cost of \$400 per acre for a total cost of \$32,000.
- Early season curly-leaf pondweed assessment and treatment. Assessment and treatment of approximately 60 acres of curly-leaf pondweed will cost approximately \$7,200.
- Upstream assessment for Eurasian watermilfoil and curly-leaf pondweed should be accomplished under the early season assessment identified above and the standard LARE aquatic plant management planning assessments.
- Standard LARE assessment, public meeting, and plan update costs are based on 2006 LARE requirements (two Tier I surveys; one Tier II survey; public meeting; plan update). Assessment costs are estimated to total \$7,500, while the plan update is anticipated to occur as a cost of \$4,255. However, it should be noted that the LARE program staff stated that a map of exotic species locations should be completed prior to treatment with a post-treatment Tier II (point) survey conducted following treatment. These assessments will include a much reduced plan

update. Cost estimates for the assessment items total \$3,000, while the plan update is estimated to cost \$2,500.

Total fees for 2007 aquatic plant assessment, herbicide application, and plan updated using 2006 protocols are estimated at \$50,955. If the protocol is modified as suggested above, cost estimates total \$44,700.

The following time schedule is anticipated for aquatic plant management activities for Fish Lake in 2007:

March-April 2007	Curly-leaf pondweed assessment
April-early May, 2007	Curly-leaf pondweed treatment outside of the LARE program
May 15-June 15, 2007	Tier I assessment and/or mapping of exotics (*must occur prior to LARE-funded treatment)
May 15-June 15, 2007	LARE-funded aquatic plant treatment (Eurasian watermilfoil)
July 15-August 30, 2007	Tier I and/or Tier II post-treatment assessment
August-September, 2007	Public meeting
November 2007	Meeting between IDNR LARE and fisheries staff, FLCD, and contractors
December 15, 2007	Plan update and permit and LARE application for 2008 funding due

#### **14.0 Monitoring and Plan Update Procedures**

Monitoring shall follow procedures determined by the LARE program. Likewise, plan updates will conform to LARE requirements. Additional monitoring may occur outside of the LARE program. This could include, but is not limited to: early season assessment and treatment for curly-leaf pondweed, assessment and treatment of upstream areas to limit Eurasian watermilfoil regrowth, and FLCD-funded aquatic plant assessments. As these items are not part of the LARE program, their inclusion in any future LARE aquatic plant management plan updates is not required; however, their inclusion is suggested as a mechanism to contain all pertinent aquatic plant management information in one location and deal with changes in community and treatment requirements at one time even if all actions are not funded through the LARE program.

#### **15.0 References Cited**

Weed Patrol. 2005. Fish Lakes Aquatic Vegetation Management Plan. Indiana Department of Natural Resources, Division of Soil Conservation, Indianapolis, Indiana.

Indiana Department of Natural Resources. 2006a. Tier I aquatic vegetation survey protocol. Indianapolis, Indiana.

Indiana Department of Natural Resources. 2006b. Tier II aquatic vegetation survey protocol. Indianapolis, Indiana.

Pearson, J. 2004. A sampling method to assess occurrence, abundance and distribution of submersed aquatic plants in Indiana lakes. Indiana Department of Natural Resources, Division of Fish and Wildlife, Indianapolis, Indiana.





**APPENDIX A:**  
**SPRING TIER I SURVEY DATASHEETS**  
**FISH LAKE**  
**AQUATIC PLANT MANAGEMENT PLAN UPDATE**



Abbreviation	Scientific Name	Common Name	Stratum
ACESAI	<i>Acer saccharium</i>	Silver maple	Emergent
CERDEM	<i>Ceratophyllum demersum</i>	Coontail	Submergent
CHARA	<i>Chara species</i>	Chara species	Submergent
DECVER	<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent
ELOCAN	<i>Elodea canadensis</i>	Common water weed	Submergent
FILALG	<i>Filamentous algae</i>	Filamentous algae	Algae
IRIVIR	<i>Iris virginica</i>	Blue-flag iris	Emergent
LEEORY	<i>Leersia oryzoides</i>	Rice cut grass	Emergent
LEMMIN	<i>Lemna minor</i>	Common duckweed	Floating
LEMTRI	<i>Lemna trisulca</i>	Star duckweed	Floating
LYTSAL	<i>Lythrum salicaria</i>	Purple loosestrife	Emergent
MYOSCI	<i>Myosotis scorpioides</i>	True forget-me-not	Emergent
MYREXA	<i>Myriophyllum exalbescent</i>	Northern water milfoil	Submergent
MYRHET	<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	Submergent
MYRSPI	<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent
NAJGUA	<i>Najas guadalupensis</i>	Southern naiad	Submergent
NUPADV	<i>Nuphar advena</i>	Spatterdock	Floating
NUPVAR	<i>Nuphar variegatum</i>	Bullhead lily	Floating
NYMTUB	<i>Nymphaea tuberosa</i>	White water lily	Floating
PELVIR	<i>Peltandra virginica</i>	Arrow arum	Emergent
PHAARU	<i>Phalaris arundinacea</i>	Reed canary grass	Emergent
POTCRI	<i>Potamogeton crispus</i>	Curly leaf pondweed	Submergent
POTFOL	<i>Potamogeton foliosus</i>	Leafy pondweed	Submergent
POTGRA	<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent
POTILL	<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent
POTPEC	<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent
POTZOS	<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent
RANLON	<i>Ranunculus longirostris</i>	White water crowfoot	Submergent
SCIAME	<i>Scirpus americanus</i>	Olney's bulrush	Emergent
SPAEUR	<i>Sparganium eurycarpum</i>	Common burreed	Emergent
SPIPOL	<i>Spirodela polyrhiza</i>	Large duckweed	Floating
TYPANG	<i>Typha angustifolia</i>	Narrow leafed cattail	Emergent
TYPLAT	<i>Typha latifolia</i>	Broad leafed cattail	Emergent
UTRGIB	<i>Utricularia gibba</i>	Humped bladderwort	Submergent
UTRVUL	<i>Utricularia vulgaris</i>	Great bladderwort	Submergent
VALAME	<i>Valisneria americana</i>	Eel grass	Submergent
WOL SP*	<i>Wolffia species</i>	Water meal species	Floating

# Aquatic Vegetation Plant Bed Data Sheet

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<b>ORGANIZATION:</b> JFNew					<b>DATE:</b> 6/6/06																																																																																																																							
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					<b>Comments:</b> Chara dense throughout. MYRSPI/CERDEM/POTCRI dense in spots. Submergent/Emergent less dense adjacent to residential areas. Plants still present and relatively dense to ~10 feet. East side- bed much narrower, dominated by POTFOL, MYRSPI, VALAME, CHARA. POTCRI/MYRSPI dense along north shore.																																																																																																																							
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# Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

ORGANIZATION: JFNew				DATE: 6/6/06	
<b>SITE INFORMATION</b>				<b>SITE COORDINATES</b>	
Plant Bed ID: 01	Waterbody Name: Upper Fish Lake			Center of the Bed	
Bed Size:				Latitude: NA	
Substrate: 6, 2	Waterbody ID:			Longitude: NA	
Marl?	Total # of Species: 36			Max. Lakeward Extent of Bed	
High Organic?	<b>Canopy Abundance at Site</b>			Latitude: NA	
	S:	N:	F:	E:	Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POTGRA	1	1		
POTILL	1		1	
POTPEC	3			
POTZOS	1			
RANLON	1		1	
SCIAME	1			
SPAEUR	1			
SPIPOL	1			
TYPANG	1			
TYPLAT	1			
UTRGIB	1		1	
UTRVUL	2		1	
VALAME	3			
WOL SP.	1		1	

## Individual Plant Bed Survey

Comments:

## REMINDER INFORMATION

<b>Substrate:</b> 1 = Silt/Clay 2 = Silt w/Sand 3 = Sand w/Silt 4 = Hard Clay 5 = Gravel/Rock 6 = Sand	<b>Marl</b> 1 = Present 0 = absent  <b>High Organic</b> 1 = Present 0 = absent	<b>Canopy:</b> 1 = < 2% 2 = 2-20% 3 = 21-60% 4 = > 60%	<b>QE Code:</b> 0 = as defined 1 = Species suspected 2 = Genus suspected 3 = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> N = Nonrooted floating F = Floating, rooted E = Emergent S = Submersed		<b>Abundance:</b> 1 = < 2% 2 = 2-20% 3 = 21-60% 4 = > 60%	<b>Voucher:</b> 0 = Not Taken 1 = Taken, not verified 2 = Taken, verified	

# Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

ORGANIZATION: JFNew		DATE: 6/6/06	
<b>SITE INFORMATION</b>		<b>SITE COORDINATES</b>	
Plant Bed ID: 02	Waterbody Name: Upper Fish Lake	Center of the Bed	
Bed Size:			
Substrate: 6, 2	Waterbody ID:	Latitude: NA	
Marl?	Total # of Species: 22	Longitude: NA	
High Organic? Yes	<b>Canopy Abundance at Site</b>		Max. Lakeward Extent of Bed
	S: 3	N: 1	F: 4
			E: 2
			Latitude: NA
			Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID	Individual Plant Bed Survey
CERDEM	1				
CHARA	2				
DECOVER	2				
ELOCAN	3				
FILALG	2				
LEMMIN	1				
LEMTRI	1				
MYRSPI	2				
NUPADV	3				
NUPVAR	2				
NYMTUB	3				
PHAARU	1				
PHRAUS	1				
POTCRI	1				
POTFOL	1		1		
POTPEC	2				
POTZOS	2				
RANLON	1		1		
SPIPOL	1				
UTRGIB	1		1		
UTRVUL	1				
WOL SP.	1		1		

Comments: Northern shoreline (only). Phrags and reed canary along northern shoreline. Emergent zone intact. Plants (emergent) less dense under NUP/NYM. Separate plant bed north of dense POTCRI/MYRSPI

## REMINDER INFORMATION

<b>Substrate:</b> 1 = Silt/Clay 2 = Silt w/Sand 3 = Sand w/Silt 4 = Hard Clay 5 = Gravel/Rock 6 = Sand	<b>Marl</b> 1 = Present 0 = absent  <b>High Organic</b> 1 = Present 0 = absent	<b>Canopy:</b> 1 = < 2% 2 = 2-20% 3 = 21-60% 4 = > 60%	<b>QE Code:</b> 0 = as defined 1 = Species suspected 2 = Genus suspected 3 = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> N = Nonrooted floating F = Floating, rooted E = Emergent S = Submersed		<b>Abundance:</b> 1 = < 2% 2 = 2-20% 3 = 21-60% 4 = > 60%	<b>Voucher:</b> 0 = Not Taken 1 = Taken, not varified 2 = Taken, varified	



Abbreviation	Scientific Name	Common Name	Stratum
CERDEM	<i>Ceratophyllum demersum</i>	Coontail	Submergent
CHARA	<i>Chara species</i>	Chara species	Submergent
DECVER	<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent
ELOCAN	<i>Elodea canadensis</i>	Common water weed	Submergent
FILALG	<i>Filamentous algae</i>	Filamentous algae	Algae
HETDUB	<i>Heteranthera dubia</i>	Water star grass	Emergent
IRIVIR	<i>Iris virginica</i>	Iris	Emergent
LEMMIN	<i>Lemna minor</i>	Common duckweed	Floating
LEMTRI	<i>Lemna trisulca</i>	Star duckweed	Floating
LYTSAL	<i>Lythrum salicaria</i>	Purple loosestrife	Emergent
MYOSCI	<i>Myosotis scorpioides</i>	True forget-me-not	Emergent
MYREXA/SIB	<i>Myriophyllum exalbescens</i>	Northern water milfoil	Submergent
MYRSPI	<i>Myriophyllum spicatum</i>	Eurasian water milfoil	Submergent
NAJGUA	<i>Najas guadalupensis</i>	Southern naiad	Submergent
NAJMAR	<i>Najas marina</i>	Spiny naiad	Submergent
NUPADV	<i>Nuphar advena</i>	Spatterdock	Floating
NUPVAR	<i>Nuphar variegatum</i>	Bullhead lily	Floating
NYMTUB	<i>Nymphaea tuberosa</i>	White water lily	Floating
PELVIR	<i>Peltandra virginica</i>	Arrow arum	Emergent
PHAARU	<i>Phalaris arundinacea</i>	Reed canary grass	Emergent
PHAAUS	<i>Phragmites australis</i>	Common reed	Emergent
POTCRI	<i>Potamogeton crispus</i>	Curly leaf pondweed	Submergent
POTFOL	<i>Potamogeton foliosis</i>	Narrow leaf pondweed	Submergent
POTGRA	<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent
POTILL	<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent
POTPEC	<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent
ROSPAL	<i>Rosa palustris</i>	Swamp rose	Emergent
SCIVAL	<i>Scirpus validus</i>	Softstem bulrush	Emergent
SPAAME	<i>Sparganium americanum</i>	American burreed	Emergent
SPIPOL	<i>Spirodela polyrhiza</i>	Large duckweed	Floating
TYPANG	<i>Typha angustifolia</i>	Narrow leafed cattail	Emergent
TYPLAT	<i>Typha latifolia</i>	Broad leafed cattail	Emergent
UTRVUL	<i>Utricularia vulgaris</i>	Common bladderwort	Submergent
VALAME	<i>Valisneria americana</i>	Eel grass	Submergent



# Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

ORGANIZATION: JFNew				DATE: 6/6/06	
<b>SITE INFORMATION</b>				<b>SITE COORDINATES</b>	
Plant Bed ID: 01	Waterbody Name: Lower Fish Lake			Center of the Bed	
Bed Size:				Latitude: NA	
Substrate: 3	Waterbody ID:			Longitude: NA	
Marl?	Total # of Species: 21			Max. Lakeward Extent of Bed	
High Organic?	<b>Canopy Abundance at Site</b>			Latitude: NA	
	S:4	N:1	F:1	E:1	Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CERDEM	1			
CHARA	3			
DECOVER	1			
ELOCAN	1			
FILALG	2			
LEMMIN	1			
LYTSAL	1			
MYREXA	1		1	
MYRSPI	2			
NAJGUA	1		1	
NUPADV	1			
NYMTUB	1			
PELVIR	1			
POTCRI	1			
POTFOL	1		1	
POTGRA	2		1	
POTILL	2			
POTPEC	3			
TYPLAT	1			
UTRVUL	1			
VALAME	3			

## Individual Plant Bed Survey

## REMINDER INFORMATION

<b>Substrate:</b> <b>1</b> = Silt/Clay <b>2</b> = Silt w/Sand <b>3</b> = Sand w/Silt <b>4</b> = Hard Clay <b>5</b> = Gravel/Rock <b>6</b> = Sand	<b>Marl</b> <b>1</b> = Present <b>0</b> = absent  <b>High Organic</b> <b>1</b> = Present <b>0</b> = absent	<b>Canopy:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>QE Code:</b> <b>0</b> = as defined <b>1</b> = Species suspected <b>2</b> = Genus suspected <b>3</b> = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> <b>N</b> = Nonrooted floating <b>F</b> = Floating, rooted <b>E</b> = Emergent <b>S</b> = Submersed		<b>Abundance:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>Voucher:</b> <b>0</b> = Not Taken <b>1</b> = Taken, not verified <b>2</b> = Taken, verified	

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# Aquatic Vegetation Plant Bed Data Sheet

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ORGANIZATION: JFNew		DATE: 6/6/06	
<b>SITE INFORMATION</b>		<b>SITE COORDINATES</b>	
Plant Bed ID: 05	Waterbody Name: Lower Fish Lake - channel	Center of the Bed	
Bed Size:		Latitude: NA	
Substrate:	Waterbody ID:	Longitude: NA	
Marl?	Total # of Species: 20	Max. Lakeward Extent of Bed	
High Organic?	<b>Canopy Abundance at Site</b>		Latitude: NA
	S:2	N:1	F:3
			E:2
			Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHARA	1			
DECOVER	2			
FILALG	1			
LEMMIN	1			
LYTSAL	1			
MYRSPI	2			
NAJMAR	1			
NUPADV	1			
NYMTUB	3			
PELVIR	2			
PHAARU	1			
POTCRI	2			
POTFOL	1		1	
POTGRA	1			
POTILL	1			
POTPEC	1			
SPAAME	1			
SPIPOL	1			
TYPLAT	1			
VALAME	1			

## Individual Plant Bed Survey

## REMINDER INFORMATION

<b>Substrate:</b> <b>1</b> = Silt/Clay <b>2</b> = Silt w/Sand <b>3</b> = Sand w/Silt <b>4</b> = Hard Clay <b>5</b> = Gravel/Rock <b>6</b> = Sand	<b>Marl</b> <b>1</b> = Present <b>0</b> = absent  <b>High Organic</b> <b>1</b> = Present <b>0</b> = absent	<b>Canopy:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>QE Code:</b> <b>0</b> = as defined <b>1</b> = Species suspected <b>2</b> = Genus suspected <b>3</b> = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> <b>N</b> = Nonrooted floating <b>F</b> = Floating, rooted <b>E</b> = Emergent <b>S</b> = Submersed		<b>Abundance:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>Voucher:</b> <b>0</b> = Not Taken <b>1</b> = Taken, not verified <b>2</b> = Taken, verified	

# Aquatic Vegetation Plant Bed Data Sheet

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ORGANIZATION: JFNew				DATE: 6/6/06	
<b>SITE INFORMATION</b>				<b>SITE COORDINATES</b>	
Plant Bed ID: 06	Waterbody Name: Lower Fish Lake			Center of the Bed	
Bed Size:				Latitude: NA	
Substrate:	Waterbody ID:			Longitude: NA	
Marl?	Total # of Species: 15			Max. Lakeward Extent of Bed	
High Organic?	<b>Canopy Abundance at Site</b>			Latitude: NA	
	S:4	N:1	F:3	E:1	Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHARA	4			
DECOVER	1			
FILALG	1			
LYTSAL	1			
MYOSCI	1			
MYRSPI	1			
NUPADV	2			
NUPVAR	2			
NYMTUB	2			
PELVIR	1			
PHRAUS	1			
POTCRI	1			
POTILL	2			
POTPEC	2			
VALAME	1			

## Individual Plant Bed Survey

## REMINDER INFORMATION

<b>Substrate:</b> <b>1</b> = Silt/Clay <b>2</b> = Silt w/Sand <b>3</b> = Sand w/Silt <b>4</b> = Hard Clay <b>5</b> = Gravel/Rock <b>6</b> = Sand	<b>Marl</b> <b>1</b> = Present <b>0</b> = absent  <b>High Organic</b> <b>1</b> = Present <b>0</b> = absent	<b>Canopy:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>QE Code:</b> <b>0</b> = as defined <b>1</b> = Species suspected <b>2</b> = Genus suspected <b>3</b> = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> <b>N</b> = Nonrooted floating <b>F</b> = Floating, rooted <b>E</b> = Emergent <b>S</b> = Submersed		<b>Abundance:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>Voucher:</b> <b>0</b> = Not Taken <b>1</b> = Taken, not verified <b>2</b> = Taken, verified	

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# Aquatic Vegetation Plant Bed Data Sheet

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ORGANIZATION: JFNew				DATE: 6/6/06	
<b>SITE INFORMATION</b>				<b>SITE COORDINATES</b>	
Plant Bed ID: 08	Waterbody Name: Lower Fish Lake			Center of the Bed	
Bed Size:					
Substrate:	Waterbody ID:			Latitude: NA	
Marl?	Total # of Species: 16			Longitude: NA	
High Organic?	Canopy Abundance at Site			Max. Lakeward Extent of Bed	
	S:3	N:1	F:4	E:1	Latitude: NA
					Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHARA	3			
DECOVER	1			
FILALG	1			
IRIVIR	1			
LEMMIN	1			
LYTSAL	1			
MYRSPI	2			
NUPVAR	3			
NYMTUB	2			
PELVIR	1			
PHAARU	1			
POTCRI	1			
POTILL	2			
POTPEC	2			
UTRVUL	1			
VALAME	2			

## Individual Plant Bed Survey

## REMINDER INFORMATION

<b>Substrate:</b> 1 = Silt/Clay 2 = Silt w/Sand 3 = Sand w/Silt 4 = Hard Clay 5 = Gravel/Rock 6 = Sand	<b>Marl</b> 1 = Present 0 = absent  <b>High Organic</b> 1 = Present 0 = absent	<b>Canopy:</b> 1 = < 2% 2 = 2-20% 3 = 21-60% 4 = > 60%	<b>QE Code:</b> 0 = as defined 1 = Species suspected 2 = Genus suspected 3 = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> N = Nonrooted floating F = Floating, rooted E = Emergent S = Submersed		<b>Abundance:</b> 1 = < 2% 2 = 2-20% 3 = 21-60% 4 = > 60%	<b>Voucher:</b> 0 = Not Taken 1 = Taken, not verified 2 = Taken, verified	

# Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

ORGANIZATION: JFNew				DATE: 6/6/06	
<b>SITE INFORMATION</b>				<b>SITE COORDINATES</b>	
Plant Bed ID: 09	Waterbody Name: Lower Fish Lake			Center of the Bed	
Bed Size:				Latitude: NA	
Substrate:	Waterbody ID:			Longitude: NA	
Marl?	Total # of Species: 14			Max. Lakeward Extent of Bed	
High Organic?	<b>Canopy Abundance at Site</b>			Latitude: NA	
	S: 3	N: 1	F: 2	E: 1	Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHARA	3			
FILALG	1			
LEMMIN	1			
LYTSAL	1			
MYRSPI	3			
NUPVAR	3			
NYMTUB	1			
PELVIR	1			
PHAARU	1			
POTCRI	1			
POTILL	2			
POTPEC	2			
UTRVUL	1			
VALAME	1			

## Individual Plant Bed Survey

## REMINDER INFORMATION

<b>Substrate:</b> <b>1</b> = Silt/Clay <b>2</b> = Silt w/Sand <b>3</b> = Sand w/Silt <b>4</b> = Hard Clay <b>5</b> = Gravel/Rock <b>6</b> = Sand	<b>Marl</b> <b>1</b> = Present <b>0</b> = absent  <b>High Organic</b> <b>1</b> = Present <b>0</b> = absent	<b>Canopy:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>QE Code:</b> <b>0</b> = as defined <b>1</b> = Species suspected <b>2</b> = Genus suspected <b>3</b> = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> <b>N</b> = Nonrooted floating <b>F</b> = Floating, rooted <b>E</b> = Emergent <b>S</b> = Submersed		<b>Abundance:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>Voucher:</b> <b>0</b> = Not Taken <b>1</b> = Taken, not verified <b>2</b> = Taken, verified	

# Aquatic Vegetation Plant Bed Data Sheet

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ORGANIZATION: JFNew				DATE: 6/6/06	
<b>SITE INFORMATION</b>				<b>SITE COORDINATES</b>	
Plant Bed ID: 10	Waterbody Name: Lower Fish Lake			Center of the Bed	
Bed Size:				Latitude: NA	
Substrate:	Waterbody ID:			Longitude: NA	
Marl?	Total # of Species: 20			Max. Lakeward Extent of Bed	
High Organic?	<b>Canopy Abundance at Site</b>			Latitude: NA	
	S:3	N:1	F:3	E:2	Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHARA	3			
FILALG	1			
HETDUB	1			
LEMMIN	1			
LYTSAL	2			
MYRSPI	2			
NUPADV	3			
NUPVAR	2			
NYMTUB	2			
PELVIR	1			
PHAARU	1			
POTCRI	1			
POTFOL	1		1	
POTILL	2			
POTPEC	2			
SCIVAL	1			
TYPLAT	1			
UTRVUL	1			
VALAME	2			
POTGRA	1			

## Individual Plant Bed Survey

## REMINDER INFORMATION

<b>Substrate:</b> 1 = Silt/Clay 2 = Silt w/Sand 3 = Sand w/Silt 4 = Hard Clay 5 = Gravel/Rock 6 = Sand	<b>Marl</b> 1 = Present 0 = absent  <b>High Organic</b> 1 = Present 0 = absent	<b>Canopy:</b> 1 = < 2% 2 = 2-20% 3 = 21-60% 4 = > 60%	<b>QE Code:</b> 0 = as defined 1 = Species suspected 2 = Genus suspected 3 = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> N = Nonrooted floating F = Floating, rooted E = Emergent S = Submersed		<b>Abundance:</b> 1 = < 2% 2 = 2-20% 3 = 21-60% 4 = > 60%	<b>Voucher:</b> 0 = Not Taken 1 = Taken, not verified 2 = Taken, verified	





Abbreviation	Scientific Name	Common Name	Stratum
CERDEM	<i>Ceratophyllum demersum</i>	Coontail	Submergent
CHARA	<i>Chara species</i>	Chara species	Submergent
CXCOMO	<i>Carex Comosa</i>	Bearded sedge	Submergent
DECVER	<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent
ELOCAN	<i>Elodea canadensis</i>	Common water weed	Submergent
FILALG	<i>Filamentous algae</i>	Filamentous algae	Algae
LEEORY	<i>Leersia oryzoides</i>	Rice cut grass	Emergent
LEMMIN	<i>Lemna minor</i>	Common duckweed	Floating
LEMTRI	<i>Lemna trisulca</i>	Star duckweed	Floating
LUDPOL	<i>Ludwigia polycarpa</i>	False loosestrife	Emergent
LYTSAL	<i>Lythrum salicaria</i>	Purple loosestrife	Emergent
MYRSPI	<i>Myriophyllum spicatum</i>	Eurasian watermilfoil	Submergent
NAJGUA	<i>Najas guadalupensis</i>	Southern naiad	Submergent
NUPADV	<i>Nuphar advena</i>	Spatterdock	Floating
NUPVAR	<i>Nuphar variegatum</i>	Bullhead lily	Floating
NYMTUB	<i>Nymphaea tuberosa</i>	White water lily	Floating
PELVIR	<i>Peltandra virginica</i>	Arrow arum	Emergent
PHRAUS	<i>Phragmites australis</i>	Common reed	Emergent
POTBER	<i>Potamogeton berchtoldii</i>	Broad-leaved small pond	Submergent
POTCRI	<i>Potamogeton crispus</i>	Curly leaf pondweed	Submergent
POTFOL	<i>Potamogeton foliosis</i>	Leafy pondweed	Submergent
POTILL	<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent
POTPEC	<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent
POTZOS	<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent
SAGLAT	<i>Sagittaria latifolia</i>	Common arrowhead	Submergent
SIPOL	<i>Spirodela polyrhiza</i>	Large duckweed	Floating
TYPLAT	<i>Typha latifolia</i>	Broad leafed cattail	Emergent
VALAME	<i>Valisneria americana</i>	Eel grass	Submergent

# Aquatic Vegetation Plant Bed Data Sheet

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ORGANIZATION: JFNew		DATE: 6/6/06	
<b>SITE INFORMATION</b>		<b>SITE COORDINATES</b>	
Plant Bed ID: Channel	Waterbody Name: Upper-Lower connecting channel	Center of the Bed	
Bed Size:		Latitude: NA	
Substrate:	Waterbody ID:	Longitude: NA	
Marl?	Total # of Species: 28	Max. Lakeward Extent of Bed	
High Organic?	<b>Canopy Abundance at Site</b>		Latitude: NA
	S: 4	N: 1	F: 2
			E: 2
		Longitude: NA	

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CERDEM	2			
CHARA	3			
CXCOMO	1			
DECVER	1			
ELOCAN	2			
FILALG	2			
LEEORY	1			
LEMMIN	1			
LEMTRI	1			
LUDPUL	1			
LYTSAL	1			
MYRSPI	2			
NAJGUA	1		1	
NUPADV	2			
NUPVAR	2			
NYMTUB	2			
PELVIR	2			
PHRAUS	1			
POTBER	1		1	
POTCRI	1			
POTFOL	1		1	
POTILL	1			

## Individual Plant Bed Survey

Comments:

## REMINDER INFORMATION

<b>Substrate:</b> <b>1</b> = Silt/Clay <b>2</b> = Silt w/Sand <b>3</b> = Sand w/Silt <b>4</b> = Hard Clay <b>5</b> = Gravel/Rock <b>6</b> = Sand	<b>Marl</b> <b>1</b> = Present <b>0</b> = absent  <b>High Organic</b> <b>1</b> = Present <b>0</b> = absent	<b>Canopy:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>QE Code:</b> <b>0</b> = as defined <b>1</b> = Species suspected <b>2</b> = Genus suspected <b>3</b> = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> <b>N</b> = Nonrooted floating <b>F</b> = Floating, rooted <b>E</b> = Emergent <b>S</b> = Submersed		<b>Abundance:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>Voucher:</b> <b>0</b> = Not Taken <b>1</b> = Taken, not varified <b>2</b> = Taken, varified	







**APPENDIX B:**  
**SUMMER TIER I SURVEY DATASHEETS AND TIER II DATA**  
**FISH LAKE**  
**AQUATIC PLANT MANAGEMENT PLAN UPDATE**



Abbreviation	Scientific Name	Common Name	Stratum
ACESAI	<i>Acer saccharium</i>	Silver maple	Emergent
ASCINC	<i>Asclepias incarnata</i>	Swamp milkweed	Submergent
CERDEM	<i>Ceratophyllum demersum</i>	Coontail	Submergent
CHARA	<i>Chara species</i>	Chara species	Submergent
DECVER	<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent
ELOCAN	<i>Elodea canadensis</i>	Common water weed	Submergent
FILALG	<i>Filamentous algae</i>	Filamentous algae	Algae
HETDUB	<i>Heteranthera dubia</i>	Water star grass	Emergent
IRIVIR	<i>Iris virginica</i>	Blue-flag iris	Emergent
LEMMIN	<i>Lemna minor</i>	Common duckweed	Floating
LEMTRI	<i>Lemna trisulca</i>	Star duckweed	Floating
LYTSAL	<i>Lythrum salicaria</i>	Purple loosestrife	Emergent
MYREXA	<i>Myriophyllum exallescens</i>	Northern water milfoil	Submergent
MYRHET	<i>Myriophyllum heterophyllum</i>	Various leaved water milfoil	Submergent
NAJFLE	<i>Najas flexilis</i>	Slender naiad	Submergent
NAJGUA	<i>Najas guadalupensis</i>	Southern naiad	Submergent
NUPADV	<i>Nuphar advena</i>	Spatterdock	Floating
NUPVAR	<i>Nuphar variegatum</i>	Bullhead lily	Floating
NYMTUB	<i>Nymphaea tuberosa</i>	White water lily	Floating
PELVIR	<i>Peltandra virginica</i>	Arrow arum	Emergent
PHAARU	<i>Phalaris arundinacea</i>	Reed canary grass	Emergent
POTCRI	<i>Potamogeton crispus</i>	Curly leaf pondweed	Submergent
POTFOL	<i>Potamogeton foliosus</i>	Leafy pondweed	Submergent
POTGRA	<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent
POTILL	<i>Potamogeton illinoensis</i>	Illinois pondweed	Submergent
POTPEC	<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent
POTZOS	<i>Potamogeton zosteriformis</i>	Flat-stem pondweed	Submergent
RANLON	<i>Ranunculus longirostris</i>	White water crowfoot	Submergent
SAGLAT	<i>Scirpus americanus</i>	Olney's bulrush	Emergent
SCIPUN	<i>Scirpus pungens</i>	Chairmaker's rush	Emergent
SCIVAL	<i>Scirpus validus</i>	Soft-stem bulrush	Emergent
SPAEUR	<i>Sparganeum eurycarpum</i>	Common burreed	Emergent
SPIPOL	<i>Spirodela polyrhiza</i>	Large duckweed	Floating
TYPANG	<i>Typha angustifolia</i>	Narrow leafed cattail	Emergent
TYPLAT	<i>Typha latifolia</i>	Broad leafed cattail	Emergent
UTRGIB	<i>Utricularia gibba</i>	Humped bladderwort	Submergent
UTRVUL	<i>Utricularia vulgaris</i>	Great bladderwort	Submergent
VALAME	<i>Valisneria americana</i>	Eel grass	Submergent
WOLCOL	<i>Wolffia columbiana</i>	Columbia watermeal	Floating









Abbreviation	Scientific Name	Common Name	Stratum
CERDEM	<i>Ceratophyllum demersum</i>	Coontail	Submergent
CHARA	<i>Chara species</i>	Chara species	Submergent
COROBL	<i>Cornus obliqua</i>		Emergent
DECVER	<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent
FILALG	<i>Filamentous algae</i>	Filamentous algae	Algae
IRIVIR	<i>Iris virginica</i>	Iris	Emergent
LEEORY	<i>Leersia oryzoides</i>	Rice cutgrass	Emergent
LEMMIN	<i>Lemna minor</i>	Common duckweed	Floating
LYTSAL	<i>Lythrum salicaria</i>	Purple loosestrife	Emergent
MYREXA	<i>Myriophyllum exalbescens</i>	Northern water milfoil	Submergent
MYRHET	<i>Myriophyllum heterophyllum</i>	Various-leaved water milfo	Submergent
NAJFLE	<i>Najas flexilis</i>	Slender naiad	Submergent
NAJGUA	<i>Najas guadalupensis</i>	Southern naiad	Submergent
NAJMAR	<i>Najas marina</i>	Spiny naiad	Submergent
NUPADV	<i>Nuphar advena</i>	Spatterdock	Floating
NUPVAR	<i>Nuphar variegatum</i>	Bullhead lily	Floating
NYMTUB	<i>Nymphaea tuberosa</i>	White water lily	Floating
PELVIR	<i>Peltandra virginica</i>	Arrow arum	Emergent
PHAARU	<i>Phalarus arundinacaea</i>	Reed canary grass	Emergent
POTBER	<i>Potamogeton berchtoldii</i>		Submergent
POTCRI	<i>Potamogeton crispus</i>	Curly leaf pondweed	Submergent
POTGRA	<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent
POTILL	<i>Potamogeton illinoiensis</i>	Illinois pondweed	Submergent
POTPEC	<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent
SCIVAL	<i>Scirpus validus</i>	Softstem bulrush	Emergent
SPAAME	<i>Sparganium americanum</i>	American burreed	Emergent
SPAEUR	<i>Sparganeum eurycarpum</i>	Common burreed	Emergent
SIPOL	<i>Spirodela polyrhiza</i>	Large duckweed	Floating
TYPLAT	<i>Typha latifolia</i>	Broad leafed cattail	Emergent
UTRGIB	<i>Utricularia gibba</i>	Humped bladderwort	Submergent
UTRVUL	<i>Utricularia vulgaris</i>	Common bladderwort	Submergent
VALAME	<i>Valisneria americana</i>	Eel grass	Submergent

# Aquatic Vegetation Plant Bed Data Sheet

Page 1 of 10

State of Indiana Department of Natural Resources

<b>ORGANIZATION:</b> JFNew					<b>DATE:</b> 8/14/06				
<b>SITE INFORMATION</b>					<b>SITE COORDINATES</b>				
<b>Plant Bed ID: 01 (1)</b>		Waterbody Name: Lower Fish Lake			Center of the Bed				
Bed Size:									
Substrate:		Waterbody ID:			Latitude: NA				
Marl?		Total # of Species: 24			Longitude: NA				
High Organic?		<b>Canopy Abundance at Site</b>			Max. Lakeward Extent of Bed				
		S: 3	N: 1	F: 1	E: 1	Latitude: NA			
						Longitude: NA			
<b>SPECIES INFORMATION</b>									
<b>Species Code</b>		<b>Abundance</b>	<b>QE</b>	<b>Vchr.</b>	<b>Ref. ID</b>	Individual Plant Bed Survey			
CERDEM		1							
CHARA		3				Comments:			
DECVER		1							
FILALG		2							
LYTSAL		1							
MYREXA		1							
MYRHET		1							
NAJFLE		2							
NAJGUA		1							
NAJMAR		2							
NUPADV		1							
NUPVAR		1							
NYMTUB		1							
PELVIR		1							
PHAARU		1							
POTCRI		1							
POTGRA		2							
POTILL		2							
POTPEC		2							
SCIVAL		1							
SPAEUR		1							
TYPLAT		1							
<b>REMINDER INFORMATION</b>									
<b>Substrate:</b>		<b>Marl</b>		<b>Canopy:</b>		<b>QE Code:</b>		<b>Reference ID:</b>	
1 = Silt/Clay		1 = Present		1 = < 2%		0 = as defined		Unique number or	
2 = Silt w/Sand		0 = absent		2 = 2-20%		1 = Species suspected		letter to denote specific	
3 = Sand w/Silt				3 = 21-60%		2 = Genus suspected		location of a species;	
4 = Hard Clay		<b>High Organic</b>		4 = > 60%		3 = Unknown		referenced on attached map	
5 = Gravel/Rock		1 = Present							
6 = Sand		0 = absent							
				<b>Abundance:</b>		<b>Voucher:</b>			
		<b>Overall Surface Cover</b>		1 = < 2%		0 = Not Taken			
		N = Nonrooted floating		2 = 2-20%		1 = Taken, not varified			
		F = Floating, rooted		3 = 21-60%		2 = Taken, varifier			
		E = Emergent		4 = > 60%					
		S = Submersed							



## Page 2 of 10

**State of Indiana Department of Natural Resources**

[illegible]

# Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

ORGANIZATION: JFNew

DATE: 8/14/06

## SITE INFORMATION

## SITE COORDINATES

Plant Bed ID: 02

Waterbody Name: Lower Fish Lake

Center of the Bed

Bed Size:

Latitude: NA

Substrate:

Waterbody ID:

Longitude: NA

Marl?

Total # of Species: 13

Max. Lakeward Extent of Bed

High Organic?

Canopy Abundance at Site

Latitude: NA

S: 2

N: 1

F: 1

E: 1

Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CERDEM	1			
CHARA	2			
DECVER	1			
LYTSAL	1			
NAJFLE	1			
NAJGUA	1			
NAJMAR	2			
PELVIR	1			
POTGRA	2			
POTILL	2			
POTPEC	1			
UTRVUL	1			
VALAME	1			

## Individual Plant Bed Survey

Comments:

## REMINDER INFORMATION

Substrate:

Marl

1 = Silt/Clay

1 = Present

2 = Silt w/Sand

0 = absent

3 = Sand w/Silt

4 = Hard Clay

High Organic

5 = Gravel/Rock

1 = Present

6 = Sand

0 = absent

Overall Surface Cover

N = Nonrooted floating

F = Floating, rooted

E = Emergent

S = Submersed

Canopy:

1 = < 2%

2 = 2-20%

3 = 21-60%

4 = > 60%

Abundance:

1 = < 2%

2 = 2-20%

3 = 21-60%

4 = > 60%

QE Code:

0 = as defined

1 = Species suspected

2 = Genus suspected

3 = Unknown

Reference ID:

Unique number or letter to denote specific location of a species; referenced on attached map

Voucher:

0 = Not Taken

1 = Taken, not varified

2 = Taken, varifier

# Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

<b>ORGANIZATION:</b> JFNew					<b>DATE:</b> 8/14/06				
<b>SITE INFORMATION</b>					<b>SITE COORDINATES</b>				
<b>Plant Bed ID: 03-04</b>		Waterbody Name: Lower Fish Lake			Center of the Bed				
Bed Size:									
Substrate:		Waterbody ID:			Latitude: NA				
Marl?		Total # of Species: 22			Longitude: NA				
High Organic?		<b>Canopy Abundance at Site</b>			Max. Lakeward Extent of Bed				
		S: 3	N: 1	F: 1	E: 1	Latitude: NA			
					Longitude: NA				
<b>SPECIES INFORMATION</b>									
<b>Species Code</b>		<b>Abundance</b>	<b>QE</b>	<b>Vchr.</b>	<b>Ref. ID</b>	Individual Plant Bed Survey			
CHARA		3							
DECVER		1				Comments:			
FILALG		1							
LEMMIN		1							
LYTSAL		1							
MYREXA		1		1					
MYRHET		1							
NAJFLE		1							
NAJGUA		2							
NAJMAR		2							
NUPADV		1							
NUPVAR		1							
NYMTUB		1							
PELVIR		1							
POTBER		1							
POTGRA		2							
POTILL		2							
POTPEC		2							
SPIPOL		1							
TYPLAT		1							
UTRVUL		1							
VALAME		2							
<b>REMINDER INFORMATION</b>									
<b>Substrate:</b>		<b>Marl</b>		<b>Canopy:</b>		<b>QE Code:</b>		<b>Reference ID:</b>	
1 = Silt/Clay		1 = Present		1 = < 2%		0 = as defined		Unique number or	
2 = Silt w/Sand		0 = absent		2 = 2-20%		1 = Species suspected		letter to denote specific	
3 = Sand w/Silt				3 = 21-60%		2 = Genus suspected		location of a species;	
4 = Hard Clay		<b>High Organic</b>		4 = > 60%		3 = Unknown		referenced on attached map	
5 = Gravel/Rock		1 = Present							
6 = Sand		0 = absent							
				<b>Abundance:</b>		<b>Voucher:</b>			
		<b>Overall Surface Cover</b>		1 = < 2%		0 = Not Taken			
		N = Nonrooted floating		2 = 2-20%		1 = Taken, not varified			
		F = Floating, rooted		3 = 21-60%		2 = Taken, varifier			
		E = Emergent		4 = > 60%					
		S = Submersed							







# Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

<b>ORGANIZATION:</b> JFNew					<b>DATE:</b> 8/14/06																																																																																																																												
<b>SITE INFORMATION</b>					<b>SITE COORDINATES</b>																																																																																																																												
<b>Plant Bed ID: 07</b>		Waterbody Name: Lower Fish Lake			Center of the Bed																																																																																																																												
Bed Size:																																																																																																																																	
Substrate:		Waterbody ID:			Latitude: NA																																																																																																																												
Marl?		Total # of Species: 14			Longitude: NA																																																																																																																												
High Organic?		<b>Canopy Abundance at Site</b>			Max. Lakeward Extent of Bed																																																																																																																												
		S: 3      N: 1      F: 1      E: 1			Latitude: NA																																																																																																																												
					Longitude: NA																																																																																																																												
<b>SPECIES INFORMATION</b>																																																																																																																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Species Code</th> <th style="width: 15%;">Abundance</th> <th style="width: 10%;">QE</th> <th style="width: 10%;">Vchr.</th> <th style="width: 10%;">Ref. ID</th> </tr> </thead> <tbody> <tr><td>CERDEM</td><td>1</td><td></td><td></td><td></td></tr> <tr><td>CHARA</td><td>3</td><td></td><td></td><td></td></tr> <tr><td>DECVER</td><td>1</td><td></td><td></td><td></td></tr> <tr><td>MYREXA</td><td>1</td><td></td><td>1</td><td></td></tr> <tr><td>MYRHET</td><td>1</td><td></td><td></td><td></td></tr> <tr><td>NAJMAR</td><td>2</td><td></td><td></td><td></td></tr> <tr><td>NUPADV</td><td>1</td><td></td><td></td><td></td></tr> <tr><td>NYMTUB</td><td>1</td><td></td><td></td><td></td></tr> <tr><td>PELVIR</td><td>1</td><td></td><td></td><td></td></tr> <tr><td>POTBER</td><td>1</td><td></td><td>1</td><td></td></tr> <tr><td>POTGRA</td><td>2</td><td></td><td></td><td></td></tr> <tr><td>POTILL</td><td>2</td><td></td><td></td><td></td></tr> <tr><td>POTPEC</td><td>2</td><td></td><td></td><td></td></tr> <tr><td>VALAME</td><td>2</td><td></td><td></td><td></td></tr> <tr><td> </td><td></td><td></td><td></td><td></td></tr> <tr><td> </td><td></td><td></td><td></td><td></td></tr> <tr><td> </td><td></td><td></td><td></td><td></td></tr> <tr><td> </td><td></td><td></td><td></td><td></td></tr> <tr><td> </td><td></td><td></td><td></td><td></td></tr> <tr><td> </td><td></td><td></td><td></td><td></td></tr> <tr><td> </td><td></td><td></td><td></td><td></td></tr> <tr><td> </td><td></td><td></td><td></td><td></td></tr> <tr><td> </td><td></td><td></td><td></td><td></td></tr> </tbody> </table>					Species Code	Abundance	QE	Vchr.	Ref. ID	CERDEM	1				CHARA	3				DECVER	1				MYREXA	1		1		MYRHET	1				NAJMAR	2				NUPADV	1				NYMTUB	1				PELVIR	1				POTBER	1		1		POTGRA	2				POTILL	2				POTPEC	2				VALAME	2																																																	Individual Plant Bed Survey				
Species Code	Abundance	QE	Vchr.	Ref. ID																																																																																																																													
CERDEM	1																																																																																																																																
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POTBER	1		1																																																																																																																														
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# Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

ORGANIZATION: JFNew

DATE: 8/14/06

## SITE INFORMATION

## SITE COORDINATES

Plant Bed ID: 09

Waterbody Name: Lower Fish Lake

Center of the Bed

Bed Size:

Latitude: NA

Substrate:

Waterbody ID:

Longitude: NA

Marl?

Total # of Species: 13

Max. Lakeward Extent of Bed

High Organic?

Canopy Abundance at Site

Latitude: NA

S: 3

N: 1

F: 2

E: 1

Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CERDEM	1			
CHARA	3			
LYTSAL	1			
MYREXA	1		1	
MYRHET	1			
NAJMAR	1			
NUPVAR	2			
NYMTUB	1			
PELVIR	1			
POTILL	2			
POTPEC	1			
UTRVUL	1			
VALAME	2			

## Individual Plant Bed Survey

Comments:

## REMINDER INFORMATION

Substrate:

Marl

1 = Silt/Clay

1 = Present

2 = Silt w/Sand

0 = absent

3 = Sand w/Silt

4 = Hard Clay

High Organic

5 = Gravel/Rock

1 = Present

6 = Sand

0 = absent

Overall Surface Cover

N = Nonrooted floating

F = Floating, rooted

E = Emergent

S = Submersed

Canopy:

1 = < 2%

2 = 2-20%

3 = 21-60%

4 = > 60%

Abundance:

1 = < 2%

2 = 2-20%

3 = 21-60%

4 = > 60%

QE Code:

0 = as defined

1 = Species suspected

2 = Genus suspected

3 = Unknown

Reference ID:

Unique number or letter to denote specific location of a species; referenced on attached map

Voucher:

0 = Not Taken

1 = Taken, not varified

2 = Taken, varifier

# Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

ORGANIZATION: JFNew

DATE: 8/14/06

## SITE INFORMATION

## SITE COORDINATES

Plant Bed ID: 10

Waterbody Name: Lower Fish Lake

Center of the Bed

Bed Size:

Latitude: NA

Substrate:

Waterbody ID:

Longitude: NA

Marl?

Total # of Species: 18

Max. Lakeward Extent of Bed

High Organic?

Canopy Abundance at Site

Latitude: NA

S: 3

N: 1

F: 2

E: 1

Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CERDEM	1			
CHARA	3			
DECVER	1			
FILALG	1			
LYTSAL	1			
MYREXA	1			
MYRHET	1			
NUPADV	1			
NUPVAR	2			
NYMTUB	1			
PELVIR	1			
POTGRA	1			
POTILL	1			
POTPEC	1			
SCIVAL	1			
TYPLAT	1			
UTRGIB	1			
VALAME	2			

## Individual Plant Bed Survey

Comments:

## REMINDER INFORMATION

Substrate:

Marl

1 = Silt/Clay

1 = Present

2 = Silt w/Sand

0 = absent

3 = Sand w/Silt

4 = Hard Clay

High Organic

5 = Gravel/Rock

1 = Present

6 = Sand

0 = absent

Overall Surface Cover

N = Nonrooted floating

F = Floating, rooted

E = Emergent

S = Submersed

Canopy:

1 = < 2%

2 = 2-20%

3 = 21-60%

4 = > 60%

Abundance:

1 = < 2%

2 = 2-20%

3 = 21-60%

4 = > 60%

QE Code:

0 = as defined

1 = Species suspected

2 = Genus suspected

3 = Unknown

Reference ID:

Unique number or letter to denote specific location of a species; referenced on attached map

Voucher:

0 = Not Taken

1 = Taken, not varified

2 = Taken, varifier





Abbreviation	Scientific Name	Common Name	Stratum
CERDEM	<i>Ceratophyllum demersum</i>	Coontail	Submergent
CHARA	<i>Chara species</i>	Chara species	Submergent
DECVER	<i>Decodon verticillatus</i>	Whirled loosestrife	Emergent
ELOCAN	<i>Elodea canadensis</i>	Common water weed	Submergent
FILALG	<i>Filamentous algae</i>	Filamentous algae	Algae
HETDUB	<i>Heteranthera dubia</i>	Water star grass	Emergent
LEEORY	<i>Leersia oryzoides</i>	Rice cut grass	Emergent
LEMMIN	<i>Lemna minor</i>	Common duckweed	Floating
LEMTRI	<i>Lemna trisulca</i>	Star duckweed	Floating
LYTSAL	<i>Lythrum salicaria</i>	Purple loosestrife	Emergent
NAJFLE	<i>Najas flexilis</i>	Slender naiad	Submergent
NAJGUA	<i>Najas guadalupensis</i>	Southern naiad	Submergent
NUPADV	<i>Nuphar advena</i>	Spatterdock	Floating
NUPVAR	<i>Nuphar variegatum</i>	Bullhead lily	Floating
NYMTUB	<i>Nymphaea tuberosa</i>	White water lily	Floating
PELVIR	<i>Peltandra virginica</i>	Arrow arum	Emergent
PHAARU	<i>Phalaris arundinacea</i>	Reed canary grass	Emergent
POTBER	<i>Potamogeton berchtoldii</i>	Broad-leaved small pondweed	Submergent
POTCRI	<i>Potamogeton crispus</i>	Curly leaf pondweed	Submergent
POTGRA	<i>Potamogeton gramineus</i>	Grassy pondweed	Submergent
POTPEC	<i>Potamogeton pectinatus</i>	Sago pondweed	Submergent
SAGLAT	<i>Sagittaria latifolia</i>	Common arrowhead	Submergent
SCIACU	<i>Scirpus acutus</i>	Hard-stem bulrush	Emergent
SPAEUR	<i>Sparganeum eurycarpum</i>	Common burreed	Emergent
SIPOL	<i>Spirodela polyrhiza</i>	Large duckweed	Floating
TYPANG	<i>Typha angustifolia</i>	Narrow leafed cattail	Emergent
TYPLAT	<i>Typha latifolia</i>	Broad leafed cattail	Emergent
UTRGIB	<i>Utricularia gibba</i>	Humped bladderwort	Submergent
UTRVUL	<i>Utricularia vulgaris</i>	Great bladderwort	Submergent
VALAME	<i>Valisneria americana</i>	Eel grass	Submergent

# Aquatic Vegetation Plant Bed Data Sheet

Page 1 of 2

State of Indiana Department of Natural Resources

ORGANIZATION: JFNew		DATE: 8/10/06	
<b>SITE INFORMATION</b>		<b>SITE COORDINATES</b>	
Plant Bed ID: Channel	Waterbody Name: Upper-Lower connecting channel	Center of the Bed	
Bed Size:		Latitude: NA	
Substrate:	Waterbody ID:	Longitude: NA	
Marl?	Total # of Species: 30	Max. Lakeward Extent of Bed	
High Organic?	<b>Canopy Abundance at Site</b>		Latitude: NA
	S:3	N:1	F:2
		E:1	Longitude: NA

## SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CERDEM	1			
CHARA	2			
DECV	1			
ELOCAN	1			
FILDALG	1			
HETDUB	1			
LEEORY	1			
LEMMIN	1			
LEMTRI	1			
LYTSAL	1			
NAJFLE	1			
NAJGUA	2			
NUPADV	1			
NUPVAR	2			
NYMTUB	1			
PELVIR	2			
PHAARU	1			
POTBER	1			
POTCRI	1			
POTGRA	1			
POTPEC	2			
SAGLAT	1			

## Individual Plant Bed Survey

Comments:

## REMINDER INFORMATION

<b>Substrate:</b> <b>1</b> = Silt/Clay <b>2</b> = Silt w/Sand <b>3</b> = Sand w/Silt <b>4</b> = Hard Clay <b>5</b> = Gravel/Rock <b>6</b> = Sand	<b>Marl</b> <b>1</b> = Present <b>0</b> = absent  <b>High Organic</b> <b>1</b> = Present <b>0</b> = absent	<b>Canopy:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>QE Code:</b> <b>0</b> = as defined <b>1</b> = Species suspected <b>2</b> = Genus suspected <b>3</b> = Unknown	<b>Reference ID:</b> Unique number or letter to denote specific location of a species; referenced on attached map
<b>Overall Surface Cover</b> <b>N</b> = Nonrooted floating <b>F</b> = Floating, rooted <b>E</b> = Emergent <b>S</b> = Submersed		<b>Abundance:</b> <b>1</b> = < 2% <b>2</b> = 2-20% <b>3</b> = 21-60% <b>4</b> = > 60%	<b>Voucher:</b> <b>0</b> = Not Taken <b>1</b> = Taken, not verified <b>2</b> = Taken, verified	



ID	LAKE	SITE	DEPTH	X_coord	Y_coord	CERDEM	CHARA	FILALG	MYREXA	MYRHET	NAJFLE	NAJGUA	NAJMAR	POTCRI	POTFOL	POTGRA	POTILL	POTPEC	RANSP	UTRGIB	UTRVUL	VALAME	UTRGEEM
	upper	2		537535	4602080	5	5	1												1			
	upper	3	2.5	537555	4602070	3	5	3												3	1		
	upper	4	9	537536	4602170	5		1												1	1		
	upper	5	13.5	537640	4602200			1												1			
	upper	6	4	537634	4602240	5		1													1	1	
	upper	7	1.5	537609	4602290	1	5	1													1		
	upper	8	1.5	537706	4602310	1	5	1												1		1	
	upper	9	13.5	537760	4602330	1																	
	upper	10	2.5	537746	4602410	1	5	1								1						1	
	upper	11	2	537815	4602490	1	5	1								1					1	1	
	upper	12	20	537847	4602390																		
	upper	13	16	537960	4602380																		
	upper	14	13	537932	4602440																		
	upper	15	2.5	537911	4602520	1	1	1				1									1		
	upper	16	2	537932	4602560	1	1	1		1		1									1		
	upper		1.5	537986	4602560	1	5	1								1					5		
	upper	18	4	538032	4602460	5		3															
	upper	19	10	538068	4602390	5		1															
	upper	20	7	538128	4602380	1	1	1							1						1		
	upper	21	10.5	538140	4602240	5		1													1		
	upper	22	5.5	538194	4602250	5	1	1				1								1	5		
	upper	23	4.5	538264	4602230	1	1	1															
	upper	24	4	538356	4602140	1	5	1												3			
	upper	25	3.5	538423	4602060		3	1												5			
	upper	26	3.5	538399	4602050	1	1	3						1					1		1		
	upper	27	2	538312	4602040	3	5	1												1	1	1	
	upper	28	2	538251	4602060		5	1															
	upper	29	4.5	538168	4602120	1		1	1											1	1		
	upper	30	2.5	538098	4602170		3	1				1				1	1	1			5		
	upper	31	14	538004	4602200																		
	upper	32	15	537964	4602200																1		
	upper	33	2.5	537951	4602150		5	1														1	
	upper	34	17	537916	4602170																		
	upper	35	4.5	537919	4602140			1														1	
	upper	36	13.5	537885	4602130																		
	upper	37	4.5	537888	4602120																		
	upper	38	13	537850	4602100																		
	upper	39	4	537818	4602040	5		1				1										1	
	upper	40	3.5	537777	4602020	5		1															
	upper	41	14	537769	4602050			1															
	upper	42	13	537750	4602030			1															
	upper	43	2.5	537738	4601990			1															
	upper	44	2.5	537709	4601960	1	1	1				1										1	
	upper	45	2	537674	4601960		5	1														1	
	upper	46	11	537656	4602010	5		1													1		1
	upper	47	17	537630	4602080																		
	upper	48	19.5	537629	4602120																		
	upper	49	4	537535	4602130	5		1															
	upper	50	2	537499	4602110	1	1	1				1											5
	upper	51	8	537595	4601290			1															

ID	LAKE	SITE	DEPTH	X_coord	Y_coord	CERDEM	CHARA	FILALG	MYREXA	MYRHET	NAJFLE	NAJGUA	NAJMAR	POTCRI	POTFOL	POTGRA	POTILL	POTPEC	RANSP	UTRGIB	UTRVUL	VALAME	UTRGEEM
	lower	1	12	537641	4601190		5	1														3	
	lower	2	8	537572	4601230			1				3											
	lower	3	14	537575	4601150																		
	lower	4	12	537652	4601080																		
	lower	5	6.5	537719	4601000		5	1				1						1				1	
	lower	6	3.5	537588	4600970		3					1				1						1	
	lower	7	16.5	537576	4601010																		
	lower	8	14.5	537564	4601050	3		1															
	lower	9	10	537550	4601060																		
	lower	10	4	537498	4601060		5	1	1			1						1		1			
	lower	11	9	537522	4601010							1											
	lower	12	4	537569	4600980		1	1		1						1							
	lower	13	15	537547	4600900									1									
	lower	14	15	537673	4600930			1															
	lower	14	12	537724	4600940		5	1					1									1	
	lower	15	4	537772	4600900		5	1															
	lower	16	3	537792	4600800		5	1				1				1		1					
	lower	17	3.5	537905	4600600		1			1						1		3				1	
	lower	18	3	537729	4600610			1															
	lower	19	10	537743	4600510		1	1								1		1				1	
	lower	20	6	537825	4600500		5	1	1	1						1		1				1	
	lower	21	4.5	537888	4600360		1	1								1		1				1	
	lower	22	3.5	537919	4600240		5	1					3			3		1				3	
	lower	23	2.5	537837	4600220		1	1		1		1				1		1		1		1	
	lower	24	2.5	537706	4600320		5	1				1									1		
	lower	25	2.5	537637	4600440								5			1		1				1	
	lower	26	3.5	537596	4600600		1	1					5					3				1	
	lower	27	4.5	537573	4600670		1	1								1							
	lower	28	3.5	537458	4600750		5	1								3	1						
	lower	29	2.5	537358	4600790								1				1		1			1	
	lower	30	5.5	537349	4600890		1	1					5			1		1					
	lower	31	3	537312	4600970	1	5	1								1		1				1	
	lower	32	3.5	537302	4601030	1																	
	lower	33	9.5	537323	4601120	1									3			1					
	lower	34	12.5	537407	4601060	1		1		1													
	lower	35	13.5	537354	4601250	1																	
	lower	36	11.5	537389	4601320	1		1							1								
	lower	37	7.5	537436	4601390	5	3	1	1														3
	lower	38	5	537494	4601400	3	1	3															
	lower	39	5	537587	4601470		1	3		1		1		1									
	lower	40	12	537592	4601477			1															





**APPENDIX C:**  
**HYDRILLA INFORMATION**  
**FISH LAKE**  
**AQUATIC PLANT MANAGEMENT PLAN UPDATE**



# AIS

## Aquatic Invasive Species

### HYDRILLA



**COMMON NAME:** Hydrilla

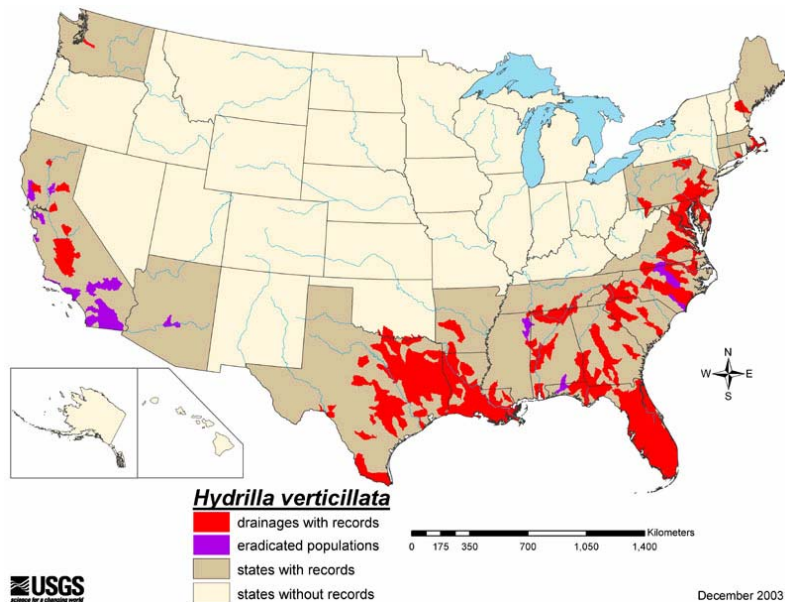
Hydrilla is also known as water thyme, Florida elodea, Wasserquirle and Indian star-vine.

**SCIENTIFIC NAME:** *Hydrilla verticillata* (L.f.) Royle

Hydrilla's scientific name is made up of the Greek word "hydro" meaning "water" and the Latin word "verticillus" that means "the whorl of a spindle". Appropriately named, it is an aquatic plant with leaves that are whorled around the stem.

Hydrilla is in the Frog's Bit family, or Hydrocharitaceae. It is the only species of the genus *Hydrilla* in the world though it resembles many of the other species in the family.

**DISTRIBUTION:** It is not really known where exactly hydrilla originated. Some sources give a broad native range of parts of Asia, Africa and Australia. Other sources are more specific and say that the dioecious form of hydrilla originated from the Indian subcontinent and the monoecious form originated from Korea. Currently the only continent without records of hydrilla is Antarctica.







December 2003

**Indiana:** Hydrilla has not been detected in Indiana waters but it is on our Aquatic Nuisance Species watch list.

### DESCRIPTION:

**Leaves:** Leaves are small about 2-4 mm wide and 6-20 mm long. They are strap-like with pointed tips and have visible saw-tooth margins. The leaves are whorled around the nodes in groups of 4-8 leaves. The leaf midvein is reddish in color and usually has a row of spines on it. This gives the plant a rough texture. The leaves are usually a green color, though topped out leaves could be bleached by the sun and appear more yellowish. Hydrilla has an axillary leaf scale called a squamula intravaginalis that is found next to the stem at the base of the leaf. This distinguishes it from the other species in the Hydrocharitaceae family. One may confuse hydrilla with another exotic weed, Brazilian elodea (*Egeria densa*). Hydrilla will have rough teeth on the underside of the leaves where Brazilian elodea will not. There is also a native species found in Indiana, American elodea (*Elodea canadensis*), which looks somewhat like hydrilla.

### Identification Characteristics of the Hydrocharitaceae

Character	Brazilian Elodea ( <i>Egeria densa</i> )	American Elodea ( <i>Elodea canadensis</i> )	Hydrilla (monoecious) ( <i>Hydrilla verticillata</i> )	Hydrilla (dioecious) ( <i>Hydrilla verticillata</i> )
Leaves per Whorl	4 (3-5) 	3(2) 	5(2-8) 	4-5 (2-8) 
Serrated Edges Visible	With magnification	With magnification	Distinct on older plants	Distinct
Leaf Size	Up to 4cm	Up to 1.5 cm	1-2 cm	1-2 cm
Flowers	Male only, up to 2 cm	Tiny, male and female on separate plants	Male and female on same plants, to 1 cm	Only female plants in US, to 1 cm
Tubers Present	No	No	Yes	Yes

**Roots/Stem:** New root sprouts are white and when growing in highly organic soil they may become brown. They are submerged and buried in the hydro-soil. Hydrilla stems are very slender only about 1/32 of an inch wide, but they can grow to lengths of 30 feet. When the stem nears the waters surface it branches out considerably. The monoecious form of hydrilla will usually start to branch out at the sediment level rather than at the top of the water.

**Flowers:** The flowers are imperfect (meaning there are separate male and female flowers) but the plant can be monoecious (flowers of both sexes on one plant) or dioecious (flowers of one

sex being produced per plant). The female flower is white with three petals that alternate with three whitish sepals. The male flower has petals and sepals similar to the female flower, but the color could be white, reddish, or brown.

**Fruits/Seeds:** Hydrilla produce two different hibernacula to cover its buds. One is called a tuber, which forms terminally on rhizomes. They can be 5-10 mm long and are off white to yellow colored. Hydrilla also produces a turions which are compact dormant buds in the leaf axil. They are 5-8 mm long, dark green in color, and they appear to be spiny. The turion will break off and settle to the bottom of the water to start a new plant. The tubers are able to over winter and re-sprout as new plants as well. Seeds are also produced.

**LIFE CYCLE BIOLOGY:** Hydrilla is a submersed, herbaceous, perennial aquatic plant. It is capable of living in many different freshwater habitats. It will grow in springs, lakes, marshes, ditches, rivers, or anywhere there is a few inches of water. Hydrilla can tolerate low nutrient and high nutrient conditions as well as a salinity of up to 7%. Another adaptation hydrilla possesses, that enable it to out compete native plants, is the ability to grow in low light conditions. It is able to grow at deeper depths and can begin to photosynthesize earlier in the morning than most other aquatic plants. In the beginning stages of life hydrilla elongates at a rate of one inch per day. This continues until the plant comes close to the top of the water, here it begins to branch out. It produces a large mat of vegetation at the waters surface intercepting the light before it can reach other plants.

Hydrilla can reproduce in four different ways, fragmentation, tubers, turions, and seed. Fragmented pieces of hydrilla that contain at least one node are capable of sprouting into a new plant. The tubers of hydrilla are formed on the rhizomes and each one can produce 6,000 new tubers. When out of water a tuber can remain viable for several days, it can even lie dormant for over 4 years in undisturbed soil before sprouting a new plant. Turions are formed in the leaf axils of the plant. They are broken off and once settled in the sediment they can sprout into a new plant. Uncharacteristic of most plants, seed production in hydrilla is of least importance for reproduction. It seems that seed production is mostly used for long distance dispersal by means of ingestion by birds. The monoecious form of hydrilla puts more energy into tuber and turion production than does the dioecious form. It is good to know which form you have to decide on the best management technique.

The main adaptations that give hydrilla an advantage over other native plants are: it can grow at low light intensities, it is better at absorbing carbon dioxide from the water, it is able to store nutrients for later use, it can tolerate a wide range of water quality conditions, and it can propagate in four different ways.

**PATHWAYS/HISTORY:** Under the name Indian star-vine, hydrilla was imported into Florida as an aquarium plant in the 1950's. A farmer living near Tampa acquired the plant but was not impressed with it and threw it out into a canal behind his business. A few months later the farmer noticed that the hydrilla grew very well and decided to market it. By the 1960's severe problems caused by hydrilla were being reported. In 1990 hydrilla could be found in 187 lakes and rivers in Florida. Because there are two different strains of hydrilla found in the United States, the monoecious strain and the dioecious strain, it is believed that there was a separate introduction outside of Florida. The dioecious form is mainly found in the southern states and California and the monoecious form is found north of South Carolina. Hydrilla was brought to

national attention in 1980 when it was discovered in the Potomac River in Washington D.C. Currently hydrilla is found in approximately 690 bodies of water within 190 drainage basins of 21 states.

**DISPERSAL/SPREAD:** Once established hydrilla can easily spread to new areas. Fragmented pieces of the plant are able to root and develop into a new plant. These plant fragments are transported to new waters via boats and fishing equipment. Hydrilla's tubers and turions allow it to persist in an area. They can live dormant in the ground and can even resist a drought. Waterfowl are a vector of transport for hydrilla as well. Some waterfowl feed on the plant and may regurgitate the tubers into other bodies of water. It has been found that these tubers are still able to sprout. Birds can also spread seeds. Hydrilla is still sold for aquarium use over the Internet, which could mean expansion of its range through more introductions, accidental or otherwise.

**RISKS/IMPACTS:** Hydrilla is sometimes called an invisible menace because most of the time you don't know it is there until it has filled the water. It will shade out native aquatic plants until they are eliminated. This forms a monoculture, which will reduce biodiversity and alter the ecosystem. Hydrilla does not only pose a threat to other plants but to animals as well. When hydrilla becomes over abundant, fish population imbalances are likely. The dense mats of hydrilla will alter the waters chemistry by raising pH, cause wide oxygen fluctuations, and increase water temperature.

Hydrilla is an economic drain. Millions of dollars are lost due to reduced recreational opportunities as hydrilla mats interfere with boating, swimming, fishing, etc. In flowing waters hydrilla will greatly reduce flow and can cause flooding. For operations that require water intake, hydrilla can pose a problem by clogging the intake pipes. Waterfront property values drop in areas infested with hydrilla. Millions of dollars are annually spent trying to control this aquatic pest.

**MANAGEMENT/PREVENTION:** Control of aquatic weeds is difficult and eradication sometimes can be an unrealistic goal. Before any type of management technique can be implemented there needs to be a positive identification of the plant. Some native plants look similar to hydrilla so it is important to have proper identification.

Hydrilla has not yet appeared in Indiana, however it is not far away. If this plant shows up in Indiana waters, it needs to be eliminated immediately. While there are many methods available to control aquatic plants, the method most suitable for complete and fast elimination is chemical control. Aquatic herbicides containing the active ingredient endothall, fluridone, or diquat are all labeled for use on hydrilla.

For states that have major infestations of this pest plant, they have looked to hydrilla's native range for any insects that could be used as a biological control. Four hydrilla-attacking insects have been released. *Bagous affinis*, a hydrilla tuber-attacking weevil and *Hydrellia pakistanae*, a leaf-mining fly both were released in 1987. *Hydrellia balciunasi* is another leaf mining fly that was released in 1989. *Bagous hydrillae*, a stem-mining weevil, was released in 1991. Many different states have released one or a combination of the four insects. It is still too early to know what long-term impacts these insects will have on hydrilla. One Indiana company is helping to develop a biological control method for hydrilla. SePro Inc. of Carmel, Indiana is a



cooperator in a project with U.S. Army Engineer Research and Development Center Environmental Laboratory to grow an endemic fungal pathogen that attacks hydrilla.

Hydrilla has been listed by the U.S. government as a Federal Noxious Weed. With this designation, it is illegal to import or sell the plant in the United States. However, it is likely that internet sales still occur.

Like all invasive species, the key to preventing their spread is knowledge! You can also help by practicing a few good techniques to stop the spread of hydrilla and other aquatic invasive plants.

- ✓ Rinse any mud and/or debris from equipment and wading gear and drain any water from boats before leaving a launch area.
- ✓ Remove all plant fragments from the boat, propeller, and boat trailer. The transportation of plant material on boats, trailers, and in livewells is the main introduction route to new lakes and rivers.
- ✓ Do not release aquarium or water garden plants into the wild, rather seal them in a plastic bag and dispose in the trash.
- ✓ Consider using plants native to Indiana in aquariums and water gardens.
- ✓ If you detect this plant in a lake, pond, or stream, immediately contact the Indiana Department of Natural Resources, Division of Fish and Wildlife.
  - (317)232-4080
  - [dkeller@dnr.IN.gov](mailto:dkeller@dnr.IN.gov)
  - 402 W. Washington St., Rm W273  
Indianapolis, IN 46204

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PHOTOGRAPHS compliments of the Washington Department of Ecology

Updated 3/05

**APPENDIX D:**

**AQUATIC PLANT TREATMENT PERMIT APPLICATION**

**FISH LAKE**

**AQUATIC PLANT MANAGEMENT PLAN UPDATE**



**APPLICATION FOR AQUATIC  
VEGETATION CONTROL PERMIT**

State Form 26727 (R / 11-03)

Approved State Board of Accounts 1987

☒ Whole Lake ☐ Multiple Treatment Areas

Check type of permit

**FOR OFFICE USE ONLY**

License No.

Date Issued

Lake County

Return to: Page 1 of       
DEPARTMENT OF NATURAL RESOURCES  
Division of Fish and Wildlife  
Commercial License Clerk  
402 West Washington Street, Room W273  
Indianapolis, IN 46204

FEE: \$5.00

INSTRUCTIONS: Please print or type information

Applicant's Name		Lake Assoc. Name
		Fish Lake Conservancy District
Rural Route or Street		Phone Number
PO Box 69		
City and State		ZIP Code
Mill Creek, Indiana		46365
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake)	Nearest Town	County
Upper Fish Lake	Fish Lake	LaPorte
Does water flow into a water supply <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		

Please complete one section for EACH treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area #	1	LAT/LONG or UTM's	
Total acres to be controlled	30	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	12	Expected date(s) of treatment(s) Once in May then once in August	
Treatment method:	<input checked="" type="checkbox"/> Chemical	<input type="checkbox"/> Physical	<input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. 2,4-D, or Renovate 3

Plant survey method: ☒ Rake ☒ Visual ☐ Other (specify) Percentages from Fall 2006 Survey

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian Watermilfoil	X	Present
Southern Naiad		6
Vallisneria		9
Slender Naiad		1
Northern Watermilfoil		1
Grassy Pondweed		5
Chara Algae		21
Coontail		27
Great Bladderwort		17
Humped Bladderwort		10
Filamentous Algae		Present
Curlyleaf Pondweed		2
Whitewater Crowfoot		1

Treatment Area #	2	LAT/LONG or UTM's	
Total acres to be controlled	25	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft)	12	Expected date(s) of treatment(s)      May - September	
Treatment method: <input checked="" type="checkbox"/> Chemical <input type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical			
Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. <u>Reward (low-dose) or Aquathol K (low-dose)</u>			
Plant survey method: <input checked="" type="checkbox"/> Rake <input type="checkbox"/> Visual <input type="checkbox"/> Other (specify) <u>Fall Survey</u>			
Aquatic Plant Name		Check if Target Species	Relative Abundance % of Community
Eurasian Watermilfoil			Present
Southern Naiad			6
Vallisneria			9
Slender Naiad			1
Northern Watermilfoil			1
Grassy Pondweed			5
Chara Algae			21
Coontail			27
Great Bladderwort			17
Humped Bladderwort			10
Filamentous Algae			Present
Curlyleaf Pondweed		X	2 (85% seasonal)
Whitewater Crowfoot			1

*INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.*

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY	
<input type="checkbox"/> Approved <input type="checkbox"/> Disapproved	Fisheries Staff Specialist
<input type="checkbox"/> Approved <input type="checkbox"/> Disapproved	Environmental Staff Specialist
Mail check or money order in the amount of \$5.00 to:  <div style="text-align: center;"> <b>DEPARTMENT OF NATURAL RESOURCES</b>  <b>DIVISION OF FISH AND WILDLIFE</b>  <b>COMMERCIAL LICENSE CLERK</b>  <b>402 WEST WASHINGTON STREET ROOM W273</b>  <b>INDIANAPOLIS, IN 46204</b> </div>	

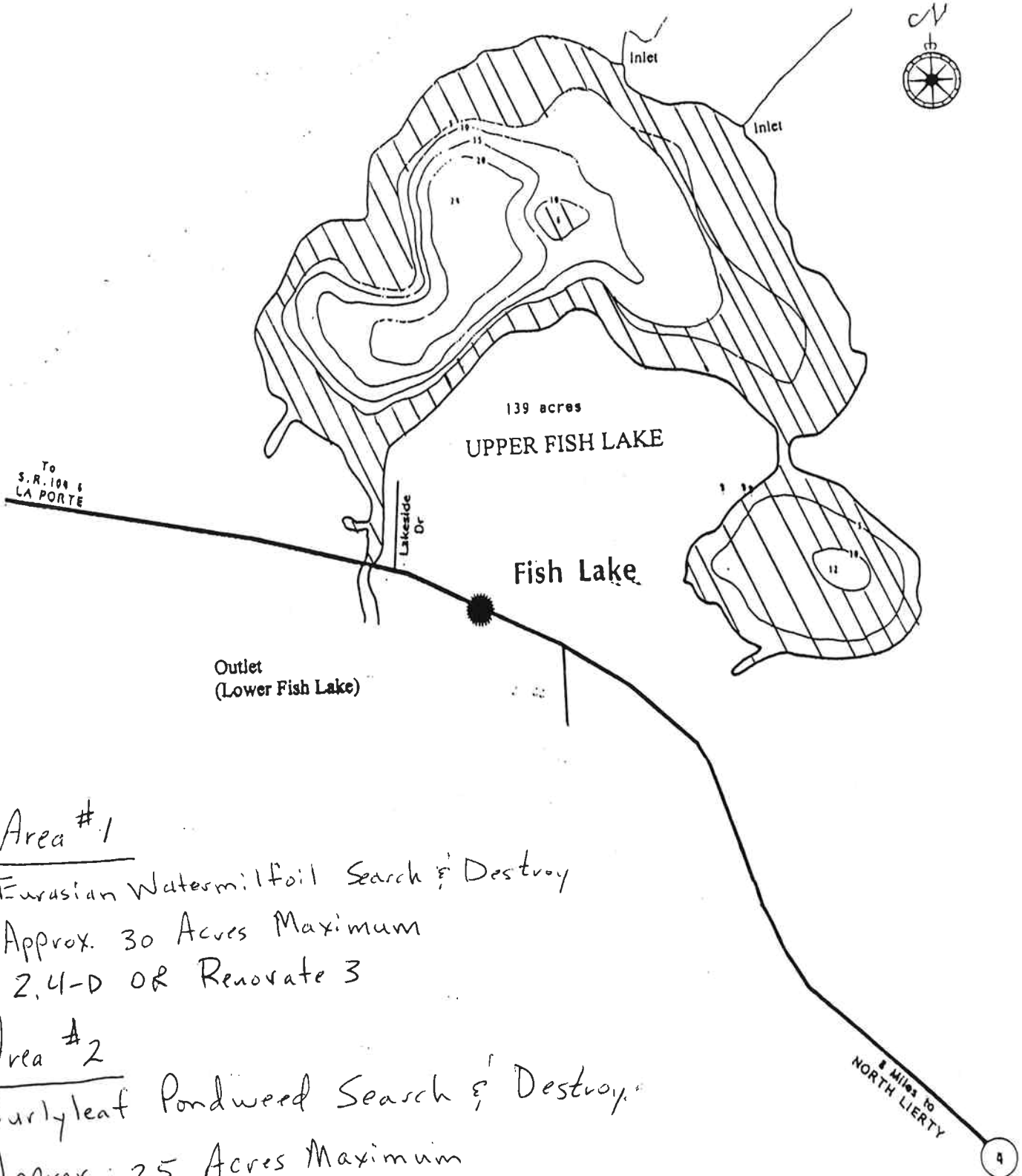






# UPPER FISH LAKE

## LAPORTE COUNTY



### Area #1

Eurasian Watermilfoil Search & Destroy

Approx. 30 Acres Maximum

2,4-D or Renovate 3

### Area #2

Curlyleaf Pondweed Search & Destroy

Approx. 25 Acres Maximum

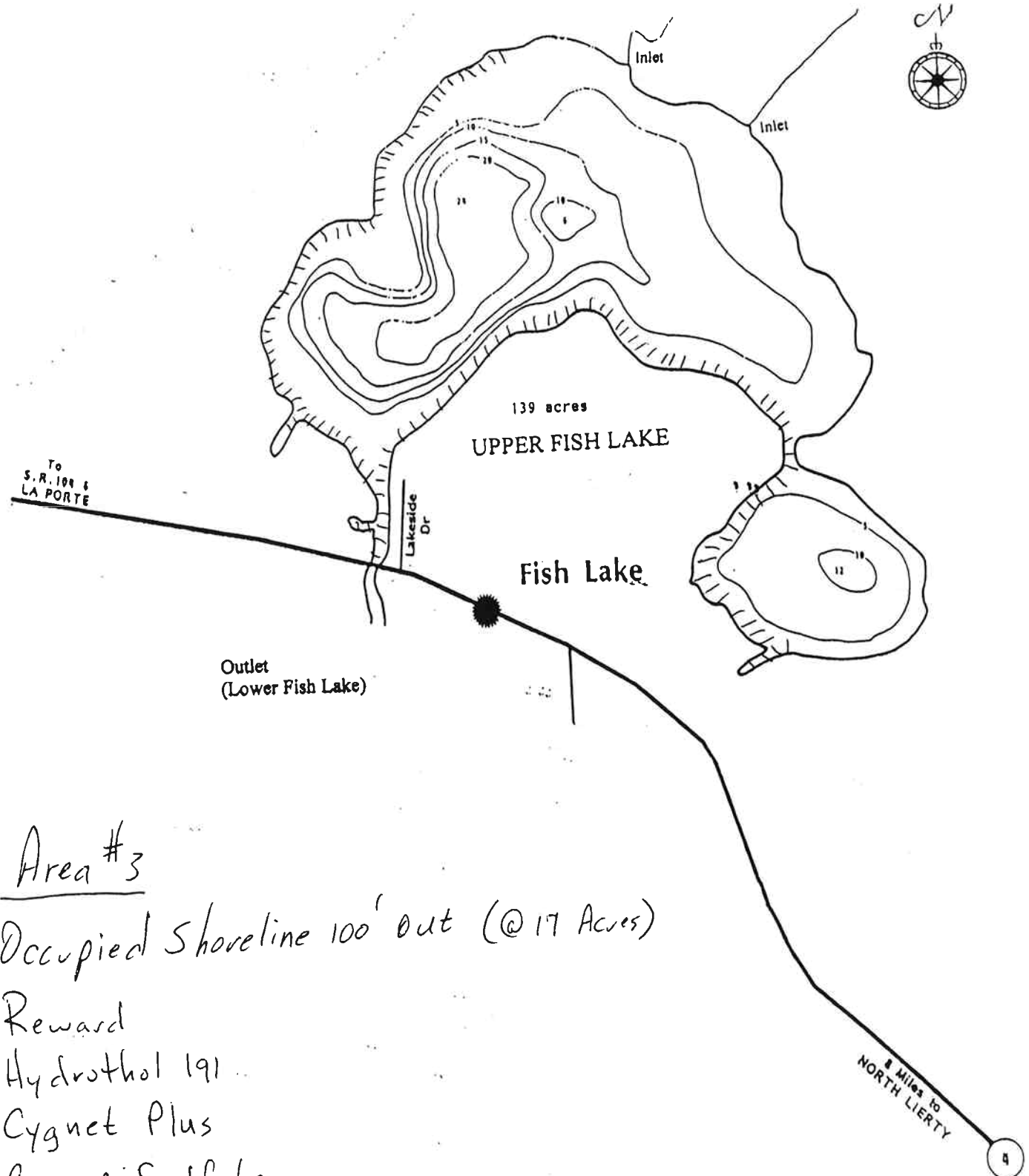
Aquathol K or Reward

Low-Dose



# UPPER FISH LAKE

## LAPORTE COUNTY



Area #3

Occupied Shoreline 100' out (@ 17 Acres)

Reward

Hydrothol 191

Cygnat Plus

Copper Sulfate





**APPLICATION FOR AQUATIC  
VEGETATION CONTROL PERMIT**

State Form 26727 (R / 11-03)

Approved State Board of Accounts 1987

☒ Whole Lake ☐ Multiple Treatment Areas

Check type of permit

**INSTRUCTIONS:** Please print or type information**FOR OFFICE USE ONLY**

License No.

Date Issued

Lake County

Return to: Page 1 of      
DEPARTMENT OF NATURAL RESOURCES  
Division of Fish and Wildlife  
Commercial License Clerk  
402 West Washington Street, Room W273  
Indianapolis, IN 46204

FEE: \$5.00

Applicant's Name		Lake Assoc. Name Fish Lake Conservancy District	
Rural Route or Street PO Box 69		Phone Number	
City and State Mill Creek, Indiana		ZIP Code 46365	
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number	
Rural Route or Street		Phone Number	
City and State		ZIP Code	

Lake (One application per lake) Lower Fish Lake	Nearest Town Fish Lake	County LaPorte
Does water flow into a water supply <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		

**Please complete one section for EACH treatment area. Attach lake map showing treatment area and denote location of any water supply intake.**

Treatment Area # 1	LAT/LONG or UTM's	
Total acres to be controlled 50	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft) 12	Expected date(s) of treatment(s) Once in May then once in August	
Treatment method: <input checked="" type="checkbox"/> Chemical <input type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical		

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. 2,4-D, or Renovate 3

Plant survey method: ☒ Rake ☒ Visual ☐ Other (specify) Percentages from Fall 2006 Survey

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian Watermilfoil	X	Present
Sago Pondweed		14
Vallisneria		13
Naiads (Spiny, Slender, Southern)		16
Northern Watermilfoil & Two Leaf Milfoil		4
Grassy Pondweed		14
Chara Algae		22
Coontail		9
Common Bladderwort		2
Narrow Leaf Pondweed & Illinois Pondweed		4
Filamentous Algae		Present
Curlyleaf Pondweed		2
Whitewater Crowfoot		1

Treatment Area # 2		LAT/LONG or UTM's	
Total acres to be controlled 35	Proposed shoreline treatment length (ft)		Perpendicular distance from shoreline (ft)
Maximum Depth of Treatment (ft) 12	Expected date(s) of treatment(s) May - September		
Treatment method: <input checked="" type="checkbox"/> Chemical <input type="checkbox"/> Physical <input type="checkbox"/> Biological Control <input type="checkbox"/> Mechanical			
Based on treatment method, describe chemical used; method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. <u>Reward (low-dose) or Aquathol K (low-dose)</u>			
Plant survey method: <input checked="" type="checkbox"/> Rake <input type="checkbox"/> Visual <input type="checkbox"/> Other (specify) <u>Fall Survey</u>			
Aquatic Plant Name		Check if Target Species	Relative Abundance % of Community
Eurasian Watermilfoil			Present
Sago Pondweed			14
Vallisneria			13
Naiads (Spiny, Slender, Southern)			16
Northern Watermilfoil & Two Leaf Milfoil			4
Grassy Pondweed			14
Chara Algae			22
Coontail			9
Common Bladderwort			2
Narrow Leaf Pondweed & Illinois Pondweed			4
Filamentous Algae			Present
Curlyleaf Pondweed		X	2 (85% Seasonal)
Whitewater Crowfoot			1
<p><i>INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.</i></p>			
Applicant Signature			Date
Certified Applicant's Signature			Date

FOR OFFICE ONLY	
<input type="checkbox"/> Approved <input type="checkbox"/> Disapproved	Fisheries Staff Specialist
<input type="checkbox"/> Approved <input type="checkbox"/> Disapproved	Environmental Staff Specialist
<p>Mail check or money order in the amount of \$5.00 to:</p> <p style="text-align: center;"><b>DEPARTMENT OF NATURAL RESOURCES</b>          DIVISION OF FISH AND WILDLIFE          COMMERCIAL LICENSE CLERK          402 WEST WASHINGTON STREET ROOM W273          INDIANAPOLIS, IN 46204</p>	





# LOWER FISH LAKE

## LAPORTE COUNTY



To  
S.R. 104 &  
LA PORTE

Inlet  
(Upper Fish Lake)

Fish Lake

LOWER FISH LAKE

134 acres

County Road 800 East

8 miles to  
NORTH LIERTY

### Area #1

Eurasian Watermilfoil Search & Destroy

Approx. 50 Acres

2,4-D or Renovate 3

### Area #2

Curlyleaf Pondweed Search & Destroy

Approx. 35 Acres

Aquathol K or Renard

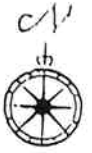
low-dose

WEED PATROL, INC.  
1922 FIELDHOUSE AVE.  
ELKHART, IN 46517



# LOWER FISH LAKE

## LAPORTE COUNTY



To  
S.R. 104 &  
LA PORTE

Inlet  
(Upper Fish Lake)

Fish Lake

LOWER FISH LAKE

134 acres

County Road 500 East

8 miles to  
NORTH LIERTY

Area #3

Occupied Shoreline 100' out  
@ 33 Acres

Reward

Hydrothol. 191

Cygnat Plus

Copper Sulfate

WEED PATROL, INC.  
1922 FIELDHOUSE AVE.  
ELKHART, IN 46517



